

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion and Magnuson-Stevens
Fishery Conservation and Management Act Essential Fish Habitat (EFH) Consultation

Leavenworth National Fish Hatchery Spring Chinook Salmon Program

NMFS Consultation Number: WCR-2015-00969

Action Agencies: United States Fish and Wildlife Service
United States Bureau of Reclamation

Affected Species and Determinations:

ESA-Listed Species	Status	Is the Action Likely to Adversely Affect Species or Critical Habitat?	Is the Action Likely To Jeopardize the Species?	Is the Action Likely To Destroy or Adversely Modify Critical Habitat?
Upper Columbia River steelhead (<i>Oncorhynchus mykiss</i>)	Threatened	Yes	No	No
Upper Columbia River spring-run Chinook salmon (<i>O. tshawytscha</i>)	Endangered	Yes	No	No

Fishery Management Plan That Describes EFH in the Project Area	Does the Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	Yes

Consultation Conducted By: The National Marine Fisheries Service, West Coast Region

Issued By:

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Date:

DRAFT - March 21, 2017

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TABLE OF CONTENTS

1			
2	1.	INTRODUCTION	1
3	1.1.	Background	1
4	1.2.	Consultation History	1
5	1.3.	Proposed Action	9
6	1.4.	Action Area	25
7	2.	ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT	28
8	2.1.	Analytical Approach--Overview	28
9	2.2.	Range-wide Status of the Species and Critical Habitat	31
10	2.2.1.	Status of Listed Species	31
11	2.2.1.1.	Life History and Status of UCR Chinook Salmon	32
12	2.2.1.2.	Life History and Status of UCR Steelhead	36
13	2.2.2.	Status of Critical Habitat	43
14	2.2.2.1.	Critical Habitat for Upper Columbia River Spring Chinook Salmon	46
15	2.2.2.2.	Critical Habitat for Upper Columbia River Steelhead	48
16	2.2.3.	Climate Change	51
17	2.3.	Environmental Baseline	53
18	2.3.1.	Land Ownership	54
19	2.3.2.	Resource Development	54
20	2.3.3.	Restoration	59
21	2.3.4.	Hatchery Propagation	61
22	2.3.5.	Fisheries	70
23	2.3.6.	Research, Monitoring, and Evaluation (RM&E)	71
24	2.4.	Effects of the Action on ESA Protected Species and on Designated Critical Habitat	
25		Error! Bookmark not defined.	
26	2.4.1.	Factors Considered When Analyzing Hatchery Effects	Error! Bookmark not
27		defined.	
28	2.4.1.1.	Factor 1. The hatchery program does or does not remove fish from the natural	
29		population and use them for hatchery broodstock	Error! Bookmark not defined.
30	2.4.1.2.	Factor 2. Hatchery fish and the progeny of naturally spawning hatchery fish on	
31		spawning grounds and encounters with natural-origin and hatchery fish at adult collection	
32		facilities Error! Bookmark not defined.	
33	2.4.1.2.1.	Genetic effects	Error! Bookmark not defined.
34	2.4.1.2.2.	Ecological effects	Error! Bookmark not defined.
35	2.4.1.2.3.	Adult Collection Facilities	Error! Bookmark not defined.

1	2.4.1.3. Factor 3. Hatchery fish and the progeny of naturally spawning hatchery fish in	
2	juvenile rearing areas	Error! Bookmark not defined.
3	2.4.1.3.1. Competition	Error! Bookmark not defined.
4	2.4.1.3.2. Predation	Error! Bookmark not defined.
5	2.4.1.3.3. Disease	Error! Bookmark not defined.
6	2.4.1.3.4. Acclimation	Error! Bookmark not defined.
7	2.4.1.4. Factor 4. Hatchery fish and the progeny of naturally spawning hatchery fish in	
8	the migration corridor, in the estuary, and in the ocean.....	Error! Bookmark not defined.
9	2.4.1.5. Factor 5. Research, monitoring, and evaluation that exists because of the	
10	hatchery program	Error! Bookmark not defined.
11	2.4.1.5.1. Observing/disturbing	Error! Bookmark not defined.
12	2.4.1.5.2. Capturing/handling.....	Error! Bookmark not defined.
13	2.4.1.5.3. Fin clipping and tagging.....	Error! Bookmark not defined.
14	2.4.1.6. Factor 6. Construction, operation, and maintenance, of facilities that exist	
15	because of the hatchery program	Error! Bookmark not defined.
16	2.4.1.7. Factor 7. Fisheries that exist because of the hatchery program.....	Error!
17	Bookmark not defined.	
18	2.4.2. Effects of the Proposed Action	Error! Bookmark not defined.
19	2.4.2.1. Factor 1. The hatchery program does or does not remove fish from the natural	
20	population and use them for hatchery broodstock	Error! Bookmark not defined.
21	2.4.2.2. Factor 2. Hatchery fish and the progeny of naturally spawning hatchery fish on	
22	spawning grounds and encounters with natural-origin and hatchery fish at adult collection	
23	facilities Error! Bookmark not defined.	
24	2.4.2.2.1. Genetic effects	Error! Bookmark not defined.
25	2.4.2.2.2. Ecological effects	Error! Bookmark not defined.
26	2.4.2.2.3. Broodstock Collection Facility Effects	Error! Bookmark not defined.
27	2.4.2.3. Factor 3. Hatchery fish and the progeny of naturally spawning hatchery fish in	
28	juvenile rearing areas	Error! Bookmark not defined.
29	2.4.2.4. Factor 4. Hatchery fish and the progeny of naturally spawning hatchery fish in	
30	the migration corridor, estuary, and ocean.....	Error! Bookmark not defined.
31	2.4.2.5. Factor 5. Research, monitoring, and evaluation that exists because of the	
32	hatchery program	Error! Bookmark not defined.
33	2.4.2.6. Factor 6. Construction, operation, and maintenance of facilities that exist	
34	because of the hatchery programs.....	Error! Bookmark not defined.
35	2.4.2.6.1. Physical effects of the LNFH instream structures on spring Chinook	
36	salmon and steelhead	Error! Bookmark not defined.
37	2.4.2.7. Factor 7. Fisheries that exist because of the hatchery program.....	Error!
38	Bookmark not defined.	

1	2.4.2.8. Effects of the Action on Critical Habitat	Error! Bookmark not defined.
2	2.5. Cumulative Effects.....	Error! Bookmark not defined.
3	2.6. Integration and Synthesis	Error! Bookmark not defined.
4	2.6.1. UCR Spring Chinook Salmon ESU and Critical Habitat.....	Error! Bookmark not defined.
5		defined.
6	2.6.2. UCR Steelhead DPS and Critical Habitat	Error! Bookmark not defined.
7	2.6.3. Climate Change.....	Error! Bookmark not defined.
8	2.7. Conclusion	Error! Bookmark not defined.
9	2.8. Incidental Take Statement.....	Error! Bookmark not defined.
10	2.8.1. Amount or Extent of Take	Error! Bookmark not defined.
11	2.8.1.1. UCR Spring Chinook Salmon	Error! Bookmark not defined.
12	2.8.1.2. UCR Steelhead	Error! Bookmark not defined.
13	2.8.2. Effect of the Take.....	Error! Bookmark not defined.
14	2.8.3. Reasonable and Prudent Measures.....	Error! Bookmark not defined.
15	2.8.4. Terms and Conditions	Error! Bookmark not defined.
16	2.9. Conservation Recommendations	Error! Bookmark not defined.
17	2.10. Reinitiation of Consultation.....	Error! Bookmark not defined.
18	3. MAGNUSON-STEVEN'S FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH	
19	HABITAT CONSULTATION	ERROR! BOOKMARK NOT DEFINED.
20	3.1. Essential Fish Habitat Affected by the Project	Error! Bookmark not defined.
21	3.2. Adverse Effects on Essential Fish Habitat.....	Error! Bookmark not defined.
22	3.3. Essential Fish Habitat Conservation Recommendations.....	Error! Bookmark not defined.
23	3.4. Statutory Response Requirement.....	Error! Bookmark not defined.
24	3.5. Supplemental Consultation	Error! Bookmark not defined.
25	4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW.....	ERROR!
26		BOOKMARK NOT DEFINED.
27	4.1. Utility	Error! Bookmark not defined.
28	4.2. Integrity.....	Error! Bookmark not defined.
29	4.3. Objectivity.....	Error! Bookmark not defined.
30	5. REFERENCES	72

Tables

Table 1. Leavenworth National Fish Hatchery HGMP, the action proponent, and funding agencies.....	10
Table 2. Federal Register notices for the final rules that list species, designate critical habitat, or apply protective regulations to ESA listed species considered in this consultation.	28

1	Table 3. Risk levels and viability ratings for natural-origin UCR spring Chinook salmon	
2	populations from 2005-2014 (NWFSC 2015).	34
3	Table 4. Estimates of the percent natural-origin spawners for UCR spring Chinook salmon	
4	populations (NWFSC 2015).	35
5	Table 5. Risk levels and viability ratings for natural-origin UCR steelhead populations from	
6	2005-2014 (NWFSC 2015).	38
7	Table 6. Estimates of the percent natural-origin spawners for UCR spring Chinook salmon	
8	populations (NWFSC 2015).	39
9	Table 7. UCR spring-run Chinook salmon criterion 1 and 2 recovery criteria (UCSRB 2007)...	42
10	Table 8. Actions called for in the UCR recovery plan (UCSRB 2007) for the LNFH spring	
11	Chinook salmon program.	42
12	Table 9. UCR steelhead criterion 1 and 2 recovery criteria (UCSRB 2007).	43
13	Table 10. PCEs of critical habitat designated for ESA-listed salmon and steelhead considered in	
14	this opinion.	45
15	Table 11. Numbers of spring Chinook smolts tagged and released from the Chiwawa hatchery	
16	program, brood years 2001-2011 (Hillman et al. 2014).	64
17	Table 12. Releases of summer Chinook salmon from the Wenatchee summer Chinook salmon	
18	hatchery program.	66
19	Table 13. Releases of summer steelhead smolts in the Wenatchee from 1998-2012 (brood year)	
20	(Hillman et al. 2014).	68
21	Table 14. Releases of coho salmon smolts in the Wenatchee Basin from 1995-2011 (brood year)	
22	{Kamphaus, 2013 #3350;Hillman, 2013 #28}.	69

Figures

26	Figure 1. Location of LNFH (USFWS 2006).	11
27	Figure 2. Proposed schedule for implementation of long-term actions for improving Icicle Creek	
28	instream flow conditions and the efficiency and reliability of hatchery water use (Irving 2015). 22	
29	Figure 3. Leavenworth National Fish Hatchery and Vicinity {USFWS, 2004 #3433}.....	27
30	Figure 4. Upper Columbia River Spring Chinook Salmon ESU (ICTRT 2008).	33
31	Figure 5. Matrix used to assess population status across VSP parameters for UCR spring	
32	Chinook salmon. Percentages for abundance and productivity scores represent the probability of	
33	extinction in a 100-year time period (NWFSC 2015).	36
34	Figure 6. Upper Columbia River steelhead DPS (ICTRT 2008).	37
35	Figure 7. Matrix used to assess population status across VSP parameters for UCR steelhead.	
36	Percentages for abundance and productivity scores represent the probability of extinction in a	
37	100-year time period (NWFSC 2015) (ICTRT 2007b).	40
38	Figure 8. Distribution of major and minor spawning areas for spring Chinook salmon in the	
39	Wenatchee Basin (UCSRB 2007).	47
40	Figure 9. Distribution of major and minor spawning areas of steelhead in the Wenatchee Basin	
41	(UCSRB 2007).	50

Acronyms and Abbreviations

1			
2			49
3			50
4	AMIP	Adaptive Management Implementation	51 MPG major population group
5		Plan	52 MSA Magnuson-Stevens Fishery Conservation
6	BA	Biological Assessment	53 Act
7	CBFWA	Columbia Basin Fish and Wildlife	54 NMFS National Marine Fisheries Service
8		Authority	55 NNI no net impact
9	CFR	Code of Federal Regulations	56 NOAA National Oceanic and Atmospheric
10	CIG	Climate Impacts Group	57 Administration
11	COIC	Cascade Orchard Irrigation Company	58 NPCC Northwest Power and Conservation
12	CPUD	Public Utility District No. 1 of Chelan	59 Council
13		County	60 NPDES National Pollutant Discharge
14	CR	Columbia River	61 Elimination System
15	CRFMP	Columbia River Fisheries Management	62 NRC National Research Council
16		Plan	63 NTTOC non-target taxa of concern
17	CWT	coded-wire tag (or tagged)	64 OFHC Olympia Fish Health Center
18	DPS	distinct population segment	65 PCE primary constituent element
19	DPUD	Public Utility District No. 1 of Douglas	66 PCSRF Pacific Coast Salmon Recovery Funds
20		County	67 PFMC Pacific Fishery Management Council
21	EFH	essential fish habitat	68 pHOS proportion of hatchery-origin spawners
22	EIS	Environmental Impact Statement	69 PIT passive integrated transponder (type of
23	ELISA	Enzyme-linked Immunosorbent Assay	70 tag)
24	EPA	U.S. Environmental Protection Agency	71 PNI proportionate natural influence
25	ESA	Endangered Species Act	72 pNOB proportion of natural origin fish in the
26	ESU	evolutionarily significant unit	73 broodstock
27	FCRPS	Federal Columbia River Power System	74 RPA Reasonable and Prudent Alternative
28	FONSI	Finding of No Significant Impact	75 RTT Upper Columbia Regional Technical
29	FR	Federal Register	76 Team
30	GPUD	Public Utility District No. 2 of Grant	77 SBA Supplemental Biological Opinion
31		County	78 SCA Supplemental Comprehensive Analysis
32	HCP	Habitat Conservation Plan	79 SIWG Species Interaction Work Group
33	HCP HC	Habitat Conservation Plan Hatchery	80 TRT Technical Recovery Team
34		Committee	81 UCR Upper Columbia River
35	HETT	Hatchery Evaluation Technical Team	82 UCSRB Upper Columbia Salmon Recovery
36	HGMP	Hatchery and Genetic Management Plan	83 Board
37	HSRG	Hatchery Scientific Review Group	84 USBR U.S. Bureau of Reclamation
38	IA	interaction availability	85 USFWS U.S. Fish and Wildlife Service
39	ICTRT	Interior Columbia Technical Review	86 VSP viable salmonid population
40		Team	87 WAC Washington Administrative Code
41	IFIM	Instream Flow Incremental Methodology	88 WDOE Washington State Department of
42	IPID	Icicle Peshastin Irrigation District	89 Ecology
43	ISAB	Independent Scientific Advisory Board	90 WSCC Washington State Conservation
44	IWG	Icicle Creek Work Group	91 Commission
45	LCR	Lower Columbia River	92 WDFW Washington Department of Fish and
46	LNFH	Leavenworth National Fish Hatchery	93 Wildlife
47	MCCRP	Mid-Columbia Coho Restoration Project	94 YN Yakama Nation
48	MCR	Middle Columbia River	
95			

1. INTRODUCTION

This introduction section provides information relevant to the other sections of this document, and is incorporated by reference into Sections 2 and 3.

1.1. Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 USC 1531 et seq.), and implementing regulations at 50 CFR 402.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801, et seq.) and implementing regulations at 50 CFR 600.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (Section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available through NMFS' Public Consultation Tracking System at: <https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts>. A complete record of this consultation is on file at the Sustainable Fisheries Division (SFD) of NMFS in Portland, Oregon.

1.2. Consultation History

The first hatchery consultations in the Columbia Basin followed the first listings of Columbia Basin salmon under the ESA. Snake River sockeye salmon were listed as an endangered species on November 20, 1991, Snake River spring/summer Chinook salmon and Snake River fall Chinook salmon were listed as threatened species on April 22, 1992, and the first hatchery consultation and opinion was completed on April 7, 1994 (NMFS 1994). The 1994 opinion was superseded by "Endangered Species Act Section 7 Biological Opinion on 1995-1998 Hatchery Operations in the Columbia River Basin, Consultation Number 383" completed on April 5, 1995 (NMFS 1995). This opinion determined that hatchery actions jeopardize listed Snake River salmon and required implementation of reasonable and prudent alternatives (RPAs) to avoid jeopardy.

A new opinion was completed on March 29, 1999, after Upper Columbia River (UCR) steelhead were listed under the ESA (62 FR 43937, August 18, 1997) and following the expiration of the previous opinion on December 31, 1998 (NMFS 1999a). That opinion concluded that Federal and non-Federal hatchery programs jeopardize Lower Columbia River (LCR) steelhead and Snake River steelhead protected under the ESA and described the Reasonable and Prudent Alternatives (RPAs) necessary to avoid jeopardy. Those measures and conditions included restricting the use of non-endemic steelhead for hatchery broodstock and limiting stray rates of non-endemic salmon and steelhead to less than 5 percent of the annual natural population in the receiving stream. Soon after, NMFS reinitiated consultation when LCR Chinook salmon, UCR spring Chinook salmon, Upper Willamette Chinook salmon, Upper Willamette steelhead,

1 Columbia River chum salmon, and Middle Columbia steelhead were added to the list of
2 endangered and threatened species (Smith 1999).

3
4 Between 1991 and the summer of 1999, the number of distinct groups of Columbia Basin salmon
5 and steelhead listed under the ESA increased from 3 to 12, and this prompted NMFS to reassess
6 its approach to hatchery consultations. In July 1999, NMFS announced that it intended to
7 conduct five consultations and issue five opinions “instead of writing one biological opinion on
8 all hatchery programs in the Columbia River Basin” (Smith 1999). Opinions would be issued for
9 hatchery programs in the (1) Upper Willamette, (2) Middle Columbia River (MCR), (3) LCR, (4)
10 Snake River, and (5) UCR, with the UCR NMFS’ first priority (Smith 1999). Between August
11 2002 and October 2003, NMFS completed consultations under the ESA for approximately
12 twenty hatchery programs in the UCR. For the MCR, NMFS completed a draft opinion and
13 distributed it to hatchery operators and to funding agencies for review on January 4, 2001, but
14 completion of consultation was put on hold pending several important basin-wide review and
15 planning processes.

16
17 The increase in ESA listings during the mid to late 1990s triggered a period of investigation,
18 planning, and reporting across multiple jurisdictions and this served to complicate, at least from a
19 resources and scheduling standpoint, hatchery consultations. A review of Federal funded
20 hatchery programs ordered by Congress was underway at about the same time that the 2000
21 Federal Columbia River Power System (FCRPS) opinion was issued by NMFS (NMFS 2000).
22 The Northwest Power and Conservation Council (NPCC) was asked to develop a set of
23 coordinated policies to guide the future use of artificial propagation, and RPA 169 of the FCRPS
24 opinion called for the completion of NMFS-approved hatchery operating plans (i.e., Hatchery
25 and Genetic Management Plans) by the end of 2003. The RPA required the Action Agencies to
26 facilitate this process, first by assisting in the development of Hatchery and Genetic Management
27 Plans (HGMPs), and then by helping to implement identified hatchery reforms (NMFS 2000).
28 Also at this time, a new *U.S. v. Oregon* Columbia River Fisheries Management Plan (CRFMP),
29 which included goals for hatchery management, was under negotiation and new information and
30 science on the status and recovery goals for salmon and steelhead was emerging from Technical
31 Recovery Teams (TRTs). Work on HGMPs under the FCRPS opinion was undertaken in
32 cooperation with NPCC’s Artificial Production Review and Evaluation process, with CRFMP
33 negotiations, and with ESA recovery planning (Foster 2004; Jones Jr. 2002). HGMPs were
34 submitted to NMFS under RPA 169; however, many were incomplete and, therefore, were not
35 found to be sufficient¹ for ESA consultation.

36
37
38 A biological assessment (BA) (USFWS 1999), including addenda (USFWS 2000a; USFWS
39 2000b), and three HGMPs (USFWS 2002a; USFWS 2002b; USFWS 2002c) were submitted for

¹ “Sufficient” means that an HGMP meets the criteria listed at 50 CFR 223.203(b)(5)(i), which include (1) the purpose of the hatchery program is described in meaningful and measureable terms, (2) available scientific and commercial information and data are included, (3) the Proposed Action, including any research, monitoring, and evaluation, is clearly described both spatially and temporally, (4) application materials provide an analysis of effects on ESA-listed species, and (5) preliminary review suggests that the program has addressed criteria for issuance of ESA authorization such that public review of the application materials would be meaningful.

the Leavenworth, Entiat, and Winthrop National Fish Hatchery facilities, addressing their rearing of UCR spring Chinook salmon. NMFS found the HGMPs to be sufficient for ESA section 7 consultation and issued a biological opinion on October 22, 2003, for hatchery operation and monitoring activities involving unlisted spring Chinook salmon as described in the HGMPs and supplemental information (NMFS 2003b). The opinion included the Leavenworth National Fish Hatchery (LNFH) spring Chinook salmon hatchery program. In that opinion, NMFS determined that operation of the spring Chinook programs would not jeopardize salmon and steelhead protected under the ESA.

(NMFS 2003b) also stated barriers to upstream fish passage associated with the LNFH program structures in Icicle Creek had been in place since 1940, and may adversely affect listed steelhead productivity in the Wenatchee River basin. This barrier to upstream fish passage was under consideration through a separate forum (the Icicle Creek Restoration Project Environmental Impact Statement (EIS) process) at the time, which included the United States Fish and Wildlife Service (USFWS), NMFS, Yakama Nation (YN), Washington Department of Fish and Wildlife (WDFW), Icicle Creek Watershed Council, and other private participants. NMFS expected that the EIS process would lead to the application of a preferred alternative that provided passage for adult and juvenile fish above the barrier, and, thus, contributed to steelhead recovery. The preferred alternative would be evaluated by NMFS for effects on ESA-listed fish through a separate section 7 consultation. The effects on ESA-listed species due to the LNFH water diversions in Icicle Creek would also be addressed by NMFS in this separate section 7(a)(2) consultation. Although an effects analysis and jeopardy determination for this portion of the LNFH operation was not rendered in the 2003 Opinion (NMFS 2003b), it was NMFS' expectation that free upstream passage for ESA-listed UCR spring Chinook salmon adults and UCR steelhead adults would be provided by the LNFH.

Following the biological opinion issued by NMFS in 2003 for the spring Chinook salmon hatchery programs at the Leavenworth, Entiat, and Methow National Fish Hatcheries, ESA consultations and an opinion were completed in 2007 for nine hatchery programs that produce a substantial proportion of the total number of salmon and steelhead released into the Columbia River annually. These programs are located in the LCR and MCR and are operated by the USFWS and by the WDFW. NMFS' opinion (NMFS 2007a) determined that operation of the programs would not jeopardize salmon and steelhead protected under the ESA.

On May 5, 2008, NMFS published a Supplemental Comprehensive Analysis (SCA) (NMFS 2008c) and an opinion and RPAs for the FCRPS to avoid jeopardizing ESA-listed salmon and steelhead in the Columbia Basin (NMFS 2008a). The SCA environmental baseline included "the past effects of hatchery operations in the Columbia River Basin. Where hatchery consultations have expired or where hatchery operations have yet to undergo ESA section 7 consultation, the effects of future operations cannot be included in the baseline. In some instances, effects are ongoing (e.g., returning adults from past hatchery practices) and included in this analysis despite the fact that future operations cannot be included in the baseline. The Proposed Action does not encompass hatchery operations per se, and therefore no incidental take coverage is offered through this biological opinion to hatcheries operating in the region. Instead, we expect the operators of each hatchery to address its obligations under the ESA in separate consultations, as required" (see NMFS 2008c, p. 5-40).

1
2 Because it was aware of the scope and complexity of ESA consultations facing the co-managers
3 and hatchery operators, NMFS offered substantial advice and guidance to help with the
4 consultations. In September 2008, NMFS announced its intent to conduct a series of ESA
5 consultations and that “from a scientific perspective, it is advisable to review all hatchery
6 programs (i.e., Federal and non-Federal) in the UCR affecting ESA-listed salmon and steelhead
7 concurrently” (Walton 2008). In November 2008, NMFS expressed again, the need for re-
8 evaluation of UCR hatchery programs and provided a “framework for ensuring that these
9 hatchery programs are in compliance with the Federal Endangered Species Act” (Jones Jr. 2008).
10 NMFS also “promised to share key considerations in analyzing HGMPs” and provided those
11 materials to interested parties in February 2009 (Jones Jr. 2009).

12
13 On April 28, 2010 (Walton 2010), NMFS issued a letter to “co-managers, hatchery operators,
14 and hatchery funding agencies” that described how NMFS “has been working with co-managers
15 throughout the Northwest on the development and submittal of fishery and hatchery plans in
16 compliance with the Federal Endangered Species Act (ESA).” NMFS stated, “In order to
17 facilitate the evaluation of hatchery and fishery plans, we want to clarify the process, including
18 consistency with *U.S. v. Oregon*, habitat conservation plans and other agreements....” With
19 respect to “Development of Hatchery and Harvest Plans for Submittal under the ESA,” NMFS
20 clarified: “The development of fishery and hatchery plans for review under the ESA should
21 consider existing agreements and be based on best available science; any applicable multiparty
22 agreements should be considered, and the submittal package should explicitly reference how
23 such agreements were considered. In the Columbia River, for example, the *U.S. v. Oregon*
24 agreement is the starting place for developing hatchery and harvest plans for ESA review....”

25
26 In response to NMFS’ 2008 announcement to review all hatchery programs, a draft HGMP was
27 submitted to NMFS for the USFWS LNFH spring Chinook salmon hatchery program in March
28 2009. This draft HGMP included information to address effects to listed species’ upstream fish
29 passage and water withdrawals not addressed in the previous opinion (NMFS 2003b). NMFS
30 provided comments and suggested edits on this draft and on subsequent versions of the HGMP
31 on February 9, June 25, and July 8, 2010.

32
33 On October 20, 2010, NMFS emailed the USFWS with comments regarding fish passage, fish
34 screens, and instream flow management at LNFH.

35
36 On December 20, 2010, NMFS held a conference call with the USFWS and the U.S. Bureau of
37 Reclamation (USBR) to discuss remaining issues regarding operation of the LNFH.

38
39 On March 21, 2011, the LNFH HGMP was revised to include the USFWS bull trout terms and
40 conditions that may apply to steelhead and formally submitted to NMFS (USFWS 2011).

41
42 In late 2011 and in 2012, there were continuing discussions and exchanges of information
43 between USFWS, USBR, and NMFS leading to a letter from the USFWS proposing to amend
44 the proposed action (Irving 2012a) to include a compliance schedule in order to meet NMFS’s
45 2011 screening criteria for anadromous fish passage (NMFS 2011c). With this amendment,
46 NMFS moved forward with the USFWS request for initiation of formal consultation under

1 section 7(a)(2) of the ESA for continuance of the LNFH spring Chinook salmon program
2 (USFWS 2011). NMFS received comments and additional information for consideration from
3 both the USFWS (Gale 2012a; Gale 2012b) and the USBR (Camp 2012a; Camp 2012b; Puckett
4 2012).

5
6 On April 30, 2012, NMFS released a draft schedule to USFWS and USBR for the LNFH section
7 7(a)(2) consultation. NMFS also communicated that the schedule may be subject to change based
8 on workload and priorities of NMFS staff (Wilson 2012).

9
10 In 2013, as the NMFS biological opinion for the LNFH HGMP was nearing completion, two
11 new studies were released by the USFWS that were highly relevant to NMFS' analysis and
12 determination of effects for operation of LNFH the: *Icicle Creek Instream Flow and Fish Habitat*
13 *Analysis for the Leavenworth National Fish Hatchery* (Skalicky et al. 2013), and the *Icicle Creek*
14 *Fish Passage Evaluation for the Leavenworth National Fish Hatchery* (Anglin et al. 2013).
15 NMFS received the new information on October 23, 2013 and promptly completed its review of
16 the data and analyses. On October 25, 2013, NMFS notified the USFWS that the studies
17 represented best available science and included substantial new scientific information that would
18 have a bearing on NMFS' analysis of the LNFH HGMP. On October 28, 2013, NMFS provided
19 revised flow recommendations to the USFWS and USBR and met with the agencies to discuss
20 the recommendations and the analytical basis for the recommendations.

21
22 On November 3, 2013, NMFS distributed the draft terms and conditions. On December 9, 2013,
23 the USFWS provided their comments to NMFS' revised terms and conditions.

24
25 On December 10, 2013, NMFS distributed a revised biological opinion, including the previously
26 distributed terms and conditions, to the USFWS and USBR for consideration and requested a
27 meeting in early January to receive comments from the USFWS and USBR and to make progress
28 towards completing section 7(a)(2) consultation.

29
30 On January 29, 2014, NMFS and USFWS met in Ellensburg, Washington, to discuss the draft
31 opinion terms and conditions. At that meeting, NMFS and the USFWS revised the terms and
32 conditions associated with the LNFH water delivery system. NMFS agreed to the revised terms
33 and conditions, and, shortly thereafter, distributed them to the USFWS and USBR for final
34 review (Wilson 2014a).

35
36 On February 24, 2014, NMFS provided USFWS and USBR with an updated draft biological
37 opinion for review including the terms and conditions developed during interagency consultation
38 on January 29, 2014.

39
40 On April 7, 2014, NMFS received an inquiry from USFWS regarding the designation of
41 steelhead critical habitat in Icicle Creek. On April 9, 2014, NMFS provided information to the
42 USFWS that confirmed the extent of the steelhead critical habitat designation in Icicle Creek
43 (Wilson 2014c). USFWS also notified NMFS that they wanted to provide additional information
44 on steelhead use of Icicle Creek for the draft biological opinion.

On April 21, 2014, USFWS requested a meeting with NMFS to discuss finalization of the draft biological opinion for the LNFH spring Chinook salmon hatchery program. On April 30, 2014, the USFWS provided: (1) a cover letter with general comments on the draft opinion and an outline of additional information the USFWS planned to provide NMFS in the near future; (2) specific comments in a marked version of the draft opinion; and (3) a final report entitled, "*Steelhead Use of Icicle Creek: A Review*" (Irving 2014b).

On May 14, 2014, the USFWS, USBR, and NMFS met to discuss the draft biological opinion. Also in attendance was the Bonneville Power Administration (BPA). At that meeting, NMFS was advised that the USFWS and USBR intended to clarify the proposed action and submit new materials, including a proposed action and analysis of effects (particularly for operation of LNFH's Structure 2 in the historical channel), to NMFS for consultation purposes before the end of calendar year 2014.

In response to the USFWS and USBR expressed intentions to revisit the proposed action and supporting materials and analysis (i.e., the HGMP for LNFH), NMFS advised that it "did not intend to conduct any further work on the matter while we waited for the action agencies to submit a revised proposed action and associated information". NMFS also communicated that we were in agreement on a request to extend the period for consultation under 50 CFR 402.14(e) and included recommended measures that would be important components of the revised proposed action (Jones Jr. 2014).

On June 24, 2014, NMFS received a letter from USFW describing its intentions to: (1) extend the LNFH section 7 consultation until the end of calendar year 2014; (2) provide additional environmental analysis of LNFH water management and operation of the structures in the Icicle Creek historical channel; (3) provide a new proposed action including a number of the conservation measures proposed by NMFS (e.g., updated fish salvage procedures and screening compliance); and (4) clarify that USFWS did not propose to revisit the HGMP submitted in 2009 for consultation. The letter also requested that NMFS provide a description of the role that Icicle Creek played in the survival and recovery of ESA-listed species. The USFWS stated that they would also consider other measures proposed by NMFS but are reserving consideration of implementing those measures in light of potential conflicts with water rights and commitments under the *U.S. v. Oregon* Management Agreement and tribal trust responsibilities (Irving 2014c).

On July 31, 2014, NMFS provided information intended to expedite the action agencies' analysis of effects on steelhead from operation of LNFH (i.e., *Appendix A: The role Icicle Creek plays in the survival and recovery of UCR steelhead*) (Jones 2014b).

On August 7, 2014, NMFS held a conference call with USFWS technical staff to discuss items needed and the timing of the LNFH supplemental biological assessment (SBA) for completion of the LNFH section 7(a)(2) consultation.

On November 4, 2014, NMFS received a letter and supplemental information from the USFWS for completion of the LNFH section 7(a)(2) consultation. The USFWS clarified that the submitted materials supplemented their original HGMP and associated documents, and clarified the information and analysis in NMFS' new draft biological opinion dated February 18, 2014

(Irving 2014a). Supplemental documents included a: (1) SBA addressing the operation and maintenance of LNFH's water delivery system and historical channel structures; (2) *Memorandum: LNFH Spring Chinook Upper Wenatchee River Impact Analysis*; and (3) *Memorandum: Determination of steelhead emergence timing in Icicle Creek*.

On November 17, 2014, NMFS requested that USFWS provide clarification on the information in the LNFH SBA regarding the operation and maintenance of the LNFH water delivery system and historical channel structures (Wilson 2014b).

On November 24, 2014, NMFS and USFSW conducted a conference call to review comments and ask questions regarding the LNFH SBA.

On December 2, 2014, NMFS, the USFSW, USBR, and BPA met to discuss completion of the LNFH section 7(a)(2) consultation. At the meeting, NMFS explained that it had completed its review of the supplemental materials provided by the USFWS and USBR and it could find nothing in the materials that attempted to address NMFS' concerns about LNFH diversions and their effects on flow conditions in the Icicle Creek historical channel. Under these circumstances, NMFS advised the USFWS and USBR that the proposed action was likely an adverse modification of designated critical habitat for ESA-listed UCR steelhead.

On April 6, 2015, NMFS requested additional clarification on specific contents of the LNFH SBA and information provided for the draft biological opinion. On April 9, 2015, USFWS provided additional clarification and information on the SBA for the draft biological opinion.

On April 17, 2015, NMFS released to the USFWS and USBR a draft biological opinion for review and comment containing an adverse modification determination for UCR steelhead critical habitat and associated Reasonable and Prudent Alternative (RPA).

On April 29, 2015, USFWS and USBOR provided NMFS comments regarding the April 17, 2015 LNFH draft biological opinion, which included concerns about the analysis (USBR 2015; USFWS 2015).

On May 1, 2015, NMFS, USFWS, USBR, and BPA met to discuss the draft biological opinion. NMFS, USFWS and USBR assigned a technical team to devise a solution that would further improve Icicle Creek instream flow conditions while allowing the LNFH to meet its production targets under *U.S. v. Oregon* to produce 1.2 million spring Chinook salmon annually.

On May 4 and May 6, 2015, the NMFS, USFWS, and USBR developed a proposal containing short-term and long-term changes to the LNFH water delivery system and hatchery infrastructure.

On May 11, 2015, the USFWS and USBR submitted a letter to NMFS requesting we consider their amendment to the proposed action (i.e., SBA) (Irving 2015). This amendment included the short-term and long-term changes to the LNFH operations. Also on May 11, 2015, the technical team met to discuss remaining comments from the USFWS and USBR on the draft biological opinion.

On May 14, 2015, NMFS sent a copy of the proposed action from the draft biological opinion (Wilson 2015), which incorporated additional details and clarification regarding the operation of the LNFH water delivery system described in the USFWS amendment (Irving 2015), to the USFWS and USBR for review and confirmation. The same day USFWS and USBR provided comments on the proposed action so that the Services could finalize the amendment.

NMFS completed a new analysis and draft biological opinion on May 18, 2015. This draft biological opinion was distributed to the USFWS and USBR for review and comment. NMFS addressed action agency comments and distributed a courtesy copy of the draft biological opinion to USFWS and USBR on May 28, 2015.

On May 29, 2015, the new biological opinion (2015 Opinion) for the LNFH was completed.

Subsequently, on July 21, 2015, the 2015 Opinion for the LNFH was challenged in court.²

On October 18, 2016, EPA submitted to NMFS a request for informal ESA consultation on a proposed National Pollution Discharge Elimination System (NPDES) permit issuance for the LNFH.

On November 22, 2016, the U.S. District Court for the Eastern District of Washington determined that the 2015 Opinion was arbitrary and capricious on the basis of how the 2015 Opinion considered climate change in the analysis of the future operations and water use at LNFH. The court remanded to NMFS for further section 7 consultation consistent with the court's opinion.

In light of the court's decision, NMFS thoroughly searched for any new scientific or commercial information that would be relevant for reanalyzing the effects of LNFH operations in the context of climate change.

Through December 2016 and January 2017, NMFS was in contact with the University of Washington Climate Impacts Group to determine whether new and relevant information is available for this opinion. On February 3, 2017, NMFS attended a climate change workshop hosted by the Bonneville Power Administration that was related to the work done by this Climate Impacts Group. The findings through this research effort are summarized in [cite to Amilee's doc] and is consistent with what was described in the 2015 Opinion.

On January 9, 2017, NMFS received [place holder for EndNote: the Icicle Creek Climate Change Report] from USFWS. Upon following up with the author from USBR through e-mails dating from January 24 to February 6, 2017, NMFS determined that the data used for this report is outdated and would be inappropriate to use as a basis for analyzing the effects of the proposed action under future the climate change.

² *Wild Fish Conservancy v. Irving*, ___ F.Supp.3d___, 2016 WL 6892082 (E.D. Wash. Nov. 22, 2016).

On January 27, 2017, NMFS received [NorWeST, VIC flow metric websites] from the Forest Service. On February 7, 2017, NMFS received a spreadsheet extracting the temperature predictions from [NorWest] from the Confederated Tribes of the Colville Reservation. On February 27, 2017, NMFS extracted flow predictions from [VIC flow metric website].

A complete record of this consultation is on file with the SFD in Portland, Oregon.

1.3. Proposed Action

“Action” means all activities, of any kind, authorized, funded, or carried out, in whole or in part, by the action agency or action agencies (50 CFR 402.02). Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration (50 CFR 402.02). See Section 1.5 for a more detailed discussion of interrelated and interdependent actions.

NMFS describes a hatchery program as a group of fish that have a separate purpose and that may have independent spawning, rearing, marking and release strategies (NMFS 2008b). The operation and management of every hatchery program is unique in time, and specific to an identifiable stock and its native habitat (Flagg et al. 2004).

The proposed action is the operation of the LNFH spring Chinook salmon hatchery program to mitigate for impacts caused by the construction and operation of Grand Coulee Dam. The proposed action also includes EPA’s issuance of NPDES permit associated with hatchery effluent discharges. During return years 1996 to 2006, LNFH contributed approximately 78,623 hatchery adults to ocean, mainstem Columbia River, and tributary fisheries in the lower mainstem Wenatchee River and Icicle Creek (Table 10 in USFWS 2011c). The Icicle Creek fishery represents one of the few opportunities for tribal harvest of spring Chinook salmon in the UCR (Irving 2015). The effects of fisheries targeting LNFH spring Chinook salmon have been evaluated under a separate ESA consultation (NMFS 2008e) and are incorporated into the environmental baseline (Section 2.3).

In this specific case, the proposed action is described in the March 21, 2011, HGMP (USFWS 2011c) with supplemented information by (Anglin et al. 2013; Gale 2012a; Gale 2012b; Irving 2012a; Irving 2012b; Puckett 2012; Skalicky et al. 2013) Camp {, 2012 #66}, Gale and Cooper (2014), Hall (2014), USFWS (2014), (Irving 2014a), (Irving 2014b), (Gale 2015), {Gale, 2015 #3431}, and (Wilson 2015). [placeholder for additional citations for NPDES – cite to EPA Biological Evaluation]

The proposed action is funded by the USBR and USFWS (Table 1). The USFWS proposes to continue operation of the LNFH spring Chinook salmon program. These hatchery spring Chinook salmon are released into Icicle Creek, which is a tributary to the Wenatchee River basin, are more than moderately diverged from the UCR spring Chinook salmon evolutionarily significant unit (ESU) and, therefore, are not included in the ESU that is listed as endangered under the ESA (NMFS 2003c). ESA-listed natural origin spring Chinook salmon currently use

Icicle Creek as a migration and spawning area to some degree (Hillman et al. 2014; USFWS 2011); however, little productivity is expected to occur (NMFS 1999b; UCSRB 2007).

The hatchery program, as described in Section 1.8 of the HGMP is an isolated program and provides fish for harvest. Fish from the program are not intended to spawn naturally and are not intended to establish, supplement, or support any spring Chinook salmon natural population(s).

Table 1. Leavenworth National Fish Hatchery HGMP, the action proponent, and funding agencies.

Hatchery and Genetics Management Plan	Action Proponent	Funding Agency
LNFH Spring Chinook Salmon	USFWS	USBR and USFWS*

* USBR funds the program from Grand Coulee operations budget, approximately 92 percent of which is reimbursed by the Bonneville Power Association (BPA). The LNFH is part of the Leavenworth Fisheries Complex and was built to mitigate for the construction and operation of Grand Coulee Dam.

The location of the LNFH in the Upper Columbia River Basin is shown in Figure 1.



1 Describing the Proposed Action

2 *Proposed hatchery broodstock collection*

- 3 • Broodstock origin and number: Broodstock used by the hatchery are more than
4 moderately diverged from the local natural population and are not included in the UCR
5 Spring Chinook Salmon ESU. Between 900 and 1,000 adult spring Chinook salmon
6 would be collected for hatchery broodstock annually {Irving, 2012 #62}. LNFH depends
7 on Carson-stock spring Chinook salmon adult returns to Icicle Creek for broodstock;
8 these spring Chinook salmon are not ESA-listed or part of the UCR Spring-Run Chinook
9 Salmon ESU. Salmon volunteering to LNFH fish ladder satisfy 100 percent of the
10 program's broodstock requirements.
- 11 • Proportion of natural origin fish in the broodstock (pNOB): The pNOB goal is zero since
12 the LNFH does not use broodstock from the local UCR spring Chinook salmon ESU.
13 LNFH spring Chinook salmon, identifiable by an adipose fin clip, would be used for
14 hatchery broodstock (see also Encounters, sorting, and handling, with ESA-listed fish,
15 adults, and juveniles below).
- 16 • Broodstock selection: A representative sample from throughout the hatchery-origin fish
17 return would be used for broodstock purposes.
- 18 • Method and location for collecting broodstock: Broodstock would be collected as they
19 voluntarily enter LNFH through the facility's fish ladder.
- 20 • Duration of collection: LNFH would keep the fish ladder open between mid-May and
21 early July to cover the full spectrum of the run within the operational constraints of the
22 hatchery³.
- 23 • Encounters, sorting, and handling, with ESA-listed fish, adults and juveniles: All natural
24 origin spring Chinook salmon incidentally encountered would be returned to Icicle Creek
25 after determining origin through a scale reading⁴. When encounters with ESA-listed
26 hatchery⁵ spring Chinook salmon occur, the USFWS will hold those fish up to three days
27 in order to identify and coordinate with the associated hatchery program operators to
28 determine the appropriate action for those fish (e.g., return to hatchery of origin for
29 broodstock, release in downstream areas, surplus, etc.). Up to 3 natural origin, 50 coded-
30 wire tagged (CWT) conservation hatchery, and 120 adipose-clipped hatchery spring
31 Chinook salmon volunteering into the LNFH ladder may be incidentally killed during
32 annual broodstock collection (up to 173 total annual incidental mortality) (Section
33 2.8.1.1, Table 31). No adult management activities are proposed for UCR steelhead;
34 natural origin and hatchery-origin adult encounters are low (i.e., <20 adult steelhead
35 during broodstock collection and operation of the water delivery system combined). Up

³ When the capacity of the adult broodstock collection pond is exceeded the ladder is closed for a short period to allow processing of fish to occur.

⁴ Scale readings are used to ensure that a mis-clipped LNFH fish is not mistaken for a natural origin adult spring Chinook salmon.

⁵ These hatchery spring Chinook salmon are determined by the presence of an adipose fin and CWT.

to 550 juvenile steelhead may be encountered during broodstock collection and the water delivery system combined (Section 2.8.1.2, Table 32).

Proposed mating protocols

- A 1:1 female to male spawning ratio is proposed. There would be no selectivity in mating. The Enzyme-Linked Immunosorbent Assay (ELISA) method would be used to detect bacterial kidney disease, and eggs would not be combined until fish health reports are complete.

Proposed protocols for each release group (annually)

- Life stage: Pre-smolts and smolts at 16-23 fish per pound (USFWS 2011).
- Acclimation (Y/N) and duration of acclimation: Yes. Fish are reared onsite at LNFH for approximately 18 months and then released directly from the facility.
- Volitional release (Y/N): No. Fish will be force-released directly from the hatchery ponds into Icicle Creek in the run below the fish ladder and spillway pool (RM 2.8) when the majority of fish exhibit smolt behavior (i.e., silvering in color, shedding of scales). The LNFH attempts to correlate pre-smolt and smolt release with a high stream-flow event that encourages smoltification in any remaining hatchery yearlings. If necessary, water flow in the release area (i.e., spillway dam) of Icicle Creek is increased for several days prior to and following hatchery releases to provide an additional stimulus for downstream migration. Staff may increase stream flows in the hatchery channel by lowering the radial gates at Structure 2 to facilitate smolt emigration during release starting in late April for 7 to 10 days. Force-releases are designed to limit the period that hatchery fish co-occur with natural origin spring Chinook salmon and steelhead (Section 2.4.2.3).
- External mark(s): 100 percent of all fish released would be adipose fin-clipped.
- Internal marks/tags: At least 200,000 fish would receive a coded-wire-tag (CWT). To evaluate post-release migration, passive integrated transponder (PIT) tags would be used as appropriate (USFWS 2011).
- Maximum number released: Maximum annual production would be 1.2 million yearling spring Chinook salmon smolts (USFWS 2011).
- Release location(s): All fish would be acclimated and released from LNFH in Icicle Creek at RM 2.8.
- Time of release: April or early May.
- Fish health certification: Reporting and control of specific fish pathogens would be in accordance with USFWS' Fish Health Policy and Implementation Guidelines through the Olympia Fish Health Center (OFHC).

1 *Proposed adult management*

- 2 • Anticipated number or range in hatchery fish returns originating from this program:
3 Working with the parties to the *U.S. v. Oregon Management Agreement (U.S. v. Oregon*
4 *2009)*, the LNFH has made a number of changes to production in the past 25 years.
5 LNFH reduced spring Chinook yearling production from 2,200,000 to 1,625,000 in
6 release year 1993. From 1995 to 2004, approximately 7,485 adults returned to Icicle
7 Creek and vicinity with average returns per spawner of 8.41 for the ten-year time period
8 (USFWS 2011). Beginning in 2008, LNFH reduced production again to 1.2 million
9 yearling spring Chinook salmon to address hatchery fish health and water quality
10 concerns. In 2012, approximately 5,370 adults returned to Icicle Creek and vicinity with
11 an average smolt-to-adult return (SAR) of 0.45% and in 2013, approximately 2,773
12 adults returned to Icicle Creek and vicinity with an average SAR of 0.23% {LaVoy, 2015
13 #3395}.
- 14 • Removal of hatchery-origin fish and the anticipated number of natural origin fish
15 encountered: All LNFH spring Chinook salmon that enter the fish ladder in Icicle Creek
16 would be removed and they would not be returned to Icicle Creek. Working in
17 conjunction with the WDFW and Public Utility District No. 1 of Chelan County (CPUD),
18 all LNFH spring Chinook salmon encountered at Tumwater Dam would also be removed.
19 This is intended to reduce the potential for genetic introgression with the Wenatchee
20 natural origin spring Chinook salmon population in the Upper Wenatchee Basin. All
21 natural origin spring Chinook salmon incidentally encountered would be returned to
22 Icicle Creek after determining origin through a scale reading. When encounters with
23 ESA-listed hatchery spring Chinook salmon occur, the USFWS will hold those fish up to
24 three days in order to identify and coordinate with the associated hatchery program
25 operators to determine the appropriate action for those fish (e.g., return to hatchery of
26 origin for broodstock, release in downstream areas, surplus, etc.). Up to 3 natural origin,
27 50 coded-wire tagged (CWT) conservation hatchery, and 120 adipose-clipped hatchery
28 spring Chinook salmon volunteering into the LNFH ladder may be incidentally killed
29 during annual broodstock collection (up to 173 total annual incidental mortality) (Section
30 2.8.1.1, Table 31). No adult management activities are proposed for UCR steelhead;
31 natural origin and hatchery-origin adult encounters are low (i.e., <20 adult steelhead
32 during broodstock collection and operation of the water delivery system combined). Up
33 to 550 juvenile steelhead may be encountered during broodstock collection and the water
34 delivery system combined (Section 2.8.1.2, Table 32).
- 35 • Appropriate uses for LNFH origin hatchery fish that are removed: Adult returns are used
36 for hatchery broodstock, harvest, and donation for human consumption (i.e., tribal
37 ceremonial and subsistence purposes, non-profit groups, etc.).
- 38 • Are hatchery fish intended to spawn naturally (Y/N): No
- 39 • Performance standard for pHOS (proportion of naturally spawning fish that are of
40 hatchery-origin): The USFWS does not propose a pHOS standard for the LNFH program
41 but intends to collect returning LNFH adults for broodstock that have escaped the spring

Chinook salmon fisheries in the ocean, Columbia River, lower Wenatchee River, and Icicle Creek.

- Performance standard for stray rates into natural spawning areas: The performance standard for stray rates as a surrogate for gene flow would be within the current range of effects for the LNFH spring Chinook salmon program analyzed in this opinion (0.8% to 3.2%) for within basin and out of basin hatchery influence (i.e., Wenatchee and Entiat spring Chinook natural origin populations).

Proposed research, monitoring, and evaluation

- Adult sampling, purpose, methodology, location, and the number of ESA-listed fish handled: The Program Operators will monitor and report information on hatchery returns, stray rates, biological characteristics of the hatchery stock, fish marking, tag recovery, and other aspects of the hatchery program. Sampling and marking of non-listed Carson-stock spring Chinook salmon (for genetic analysis, disease pathology, smolt condition, fin clipping and/or tagging, etc.) within the LNFH would not be associated with incidental take of listed species and would not pose a risk to listed spring Chinook salmon and steelhead. Annual snorkel surveys would occur below the hatchery barrier and in the pool near the fish ladder in August⁶ to determine the number of adults present after the collection ladder has been closed; spawning areas or redds are not disturbed. Numbers of fish released and associated harvest would be estimated from CWT recoveries and creel surveys. Other than analysis of CWT recoveries, there is no directed research proposed for the LNFH spring Chinook salmon program at this time.
- Juvenile sampling, purpose, methodology, location, and the number of ESA-listed fish handled: None is proposed at this time.

Proposed operation, maintenance, and construction of hatchery facilities

- Water source(s) and quantity for hatchery facilities: The Proposed action includes a combination of the following:
 - (1) A surface diversion at RM 4.5 (not to exceed 42 cubic feet per second⁷ (cfs) annually from Icicle Creek) (e.g., Structure 1),
 - (2) A water control feature at RM 3.8 (e.g., Structure 2) used to direct flow between the historical and hatchery channels of Icicle Creek with the intent to block upstream passage of LNFH origin spring Chinook salmon during broodstock collection (mid-May through June), increase flows in the hatchery channel to promote smolt emigration, recharge hatchery wells, aid in flood control, and perform routine maintenance of structures,

⁶ Annual snorkel surveys occur when the spring Chinook fishery season ends, the broodstock collection ladder closes, and in-river flows and conditions allow.

⁷ The total water withdrawal will not exceed 54 cfs: 42 cfs for LNFH year round and 12 cfs for Cascade Orchard Irrigation Company (COIC) during the irrigation season (May – September). Although the USFWS and COIC share a water diversion at RM 4.5 on Icicle Creek, only the LNFH water withdrawals are included in this proposed action.

- (3) Seven wells, and,
 (4) Supplemental flow from Snow/Nada Lake Reservoirs 1 RM above LNFH’s intake system).

Structure 1: The primary intake system is a diversion structure (e.g., low head dam, Structure 1) that spans Icicle Creek at RM 4.5. The low-head structure consists of a concrete base with flashboards on top and a pool-and-weir fish ladder. No more than 42 cfs for the LNFH⁸ is diverted into a concrete water conveyance channel with a grizzly rack (a type of exclusion rack) at the entrance. Since 2010, from mid-July through September, LNFH staff have placed a section of cyclone fence⁹ in front of the outer grizzly rack to prevent adult spring Chinook salmon and steelhead from entering the conveyance channel, and will continue to do so until the intake is updated or replaced and screening is provided within eight years of signature on this biological opinion (see Water diversions meet NMFS screen criteria (Y/N) below). Water entering the conveyance channel is transported to an intake structure that sorts coarse and fine objects that may enter the pipeline. The intake structure is inspected twice daily (beginning and end of working day) to remove accumulated debris from racks and ensure adequate flow is entering the diversion canal. Inspections occur more often during higher flows and during cold temperature periods when ice accumulates on the racks.

Structure 2: Structure 2 is a water control feature that can control instream flows in the Icicle Creek historical and hatchery channels. As described above, it is used in tandem with Structure 5 to block upstream passage of LNFH-origin spring Chinook salmon during broodstock collection¹⁰, increase flows in the hatchery channel to promote smolt emigration, recharge hatchery wells, aid in flood control, and perform routine maintenance of structures. The proposed action includes a 60% historical channel / 40% hatchery channel stream flow proposal (NMFS 2015) with a collective instream flow goal of 100 cfs¹¹ (e.g., monthly average flow) in Icicle Creek. Aquifer recharge is primarily conducted in the months of September, October, November, February, and March for up to a maximum of five times a year¹², fifteen consecutive days at a time (75 days a year maximum combination of separate events) (Irving 2015; NMFS 2015). Flows may deviate from the instream flow goal in average or dry water years or during two or more consecutive years of drought (Section 2.4.2.6.2, Tables 25, 26 and 27). Likewise, in average to wet years, instream flows may be markedly better than the proposed instream flows (Irving 2015).

Structure 5: Structure 5 is a legacy feature of past hatchery practices. It is a channel-spanning concrete sill located in the historical creek channel just above its confluence with Icicle Creek. It presently is used to seasonally prevent upstream passage of hatchery

⁸ Again, although the USFWS and COIC share a water diversion at RM 4.5 on Icicle Creek, only the LNFH water withdrawals (42 cfs year round) are included in this Federal Section 7(a)(2) consultation. From May to September, total diversions at this site are 54 cfs, which includes 12 cfs for COIC.

⁹ Cyclone fencing is plastic-coated, 4-inch mesh.

¹⁰ Broodstock collection typically occurs mid-May through June.

¹¹ The collective instream flow goal of 100 cfs includes the LNFH and all water users in Icicle Creek. The instream flow would be calculated as a monthly average flow.

¹² Typical operation of Structure 2 for aquifer recharge is twice per year.

spring-run Chinook Salmon through the historical creek channel. This is accomplished by installing picketed panels across the crest of the structure. It may also be used to facilitate monitoring by using pickets to limit the width of the dam over which fish may pass. Located downstream of Structure 2, Structure 5 cannot be used to regulate flow. Structure 5 will remain open except during times described below. If Structure 5 is closed for more than one week between May 15th and July 7th, LNFH will operate fish traps in Structure 5 to capture native species and manually move them upstream of Structure 2.

LNFH Wells: The LNFH uses seven wells for hatchery fish production. Five hatchery wells are located on the west bank of the hatchery channel and two wells are located near the hatchery's main entrance road (USFWS 2014). Hatchery wells #1-4 and #7 draw water from the shallow aquifer; well #5 delivers water from the deep aquifer; and well #6 has the capacity to draw water from both aquifers (USFWS 2014). Recharge of the shallow aquifer for well water depends on how much surface water is present to seep into groundwater in the historical and hatchery channels in Icicle Creek. Groundwater from wells is used to supplement and cool surface water for fish production. Hatchery production is sustained year round by surface water, well water, and re-circulated water (i.e., water re-circulated through hatchery raceways) (USFWS 2014).

Snow/Nada Lake Supplementation Reservoirs: The LNFH reservoirs from Snow and Nada Lakes would provide up to 50 cfs of supplemental flow in August and September to meet hatchery production needs during most years (Irving 2015; NMFS 2015). Two or more years of drought may alter release operations. If this occurs, and the USFWS determines it is necessary to alter Snow/Nada Lake Supplementation releases, re-initiation of consultation may be necessary (Cappellini 2014). A drought for more than two consecutive years is unlikely, but it would likely require a reduction in supplemental flow from the Snow/Nada Lake Supplementation Reservoirs (Cappellini 2014). The amount of reduction is unknown and would be largely dependent on the environmental conditions at the time.

The Icicle Creek Work Group¹³ (IWG) is working to develop an integrated water management plan for Icicle Creek. An instream flow subcommittee evaluated available information (e.g., Anglin et al. 2013) and developed a set of instream flow targets for all water users that the IWG adopted to improve the habitat quality and ecological function of Icicle Creek. These recommendations were a minimum flow of 100 cfs in an average water year (50th exceedance) and a minimum flow of 60 cfs during a dry water year (90th exceedance) (Irving 2015). As described above, the USFWS has established a collective instream flow management goal of 100 cfs in Icicle Creek¹⁴ (Irving 2015) as part of its proposed action. The following describes short-term and long-term actions that

¹³ A coalition of local water users, federal, state, and local government biologists, and other interested parties working together to improve efficiency of water use and instream flows in Icicle Creek.

¹⁴ Again, this goal is based on recommendations of the Icicle Creek Work Group (IWG), a coalition of local water users, federal, state, and local biologists, stakeholders, and interested parties working together to develop an integrated water management plan for Icicle Creek Irving, D. B. 2015. Addendum to the USFWS Supplemental Biological Assessment - Water Use at Leavenworth National Fish Hatchery: A Plan for Interim and long-term actions to further improve stream flows. May 11, 2015. U.S. Fish and Wildlife Service, Leavenworth, Washington..

the LNFH would implement within eight years of signature on this biological opinion regarding surface water withdrawals and operation of Structure 2 for aquifer recharge to contribute towards achieving this collective instream flow goal for all Icicle Creek water users.

SHORT-TERM OPERATIONS OF LNFH SURFACE WATER WITHDRAWAL

- Surface water withdrawals would divert up to 42 cfs year-round to meet production needs for the rearing of 1.2 million spring Chinook salmon as described in the USFWS Supplemental Biological Assessment (SBA) (NMFS 2015) until infrastructure improvements are completed that have the potential to reduce water diversions by as much as 20 cfs annually.
 - USFWS has adopted a collective instream flow goal of 100 cfs in Icicle Creek.
 - LNFH would maximize instream flows to the extent practicable while continuing Structure 1 diversions of up to 42 cfs. The instream flow goal of 100 cfs would likely be met in most years (i.e., average and dry water years combined). Circumstances where the LNFH may need to deviate from this instream flow goal to meet production targets within the eight-year period are described and analyzed in Section 2.4.2.6.2, Tables 25, 26, and 27.
- Use of Snow/Nada Lake Supplementation Reservoirs would be evaluated to determine the efficiency and scope of expanded use of this resource as a means to ensure access to the LNFH's surface water right, and improve instream flows outside of the current supplementation period (i.e., August and September).

SHORT-TERM OPERATIONS OF STRUCTURE 2 FOR AQUIFER RECHARGE

- During dry water years, given the current water use in Icicle Creek, availability of adequate natural instream flows, and the use of Structure 2 for aquifer recharge, meeting a 100 cfs instream flow may be problematic outside of April – July time period¹⁵. To address this issue, the LNFH will do the following:
 - Structure 2 will not be operated for aquifer recharge in August.
 - In September, if the natural flow remaining after subtracting the amount of water diverted by the LNFH and all water users is less than 60 cfs, the LNFH will not route more water into the hatchery channel than the volume of its Snow/Nada Lake storage release (up to 50 cfs) minus the diversion at Structure 1 (up to 42 cfs).
 - In March, Structure 2 will only be operated if adult steelhead have not been detected in Icicle Creek¹⁶.
 - The instream flow goal of 100 cfs would likely be met in most years (i.e., average and dry water years combined). When the LNFH production

¹⁵ As expressed as a monthly average flow when examining monthly average instream flows from 1994 to 2014.

¹⁶ Steelhead presence will be determined through examination of PIT detection data in the mainstem Columbia River, the Wenatchee River, and lower Icicle Creek Irving, D. B. 2015. Addendum to the USFWS Supplemental Biological Assessment - Water Use at Leavenworth National Fish Hatchery: A Plan for Interim and long-term actions to further improve stream flows. May 11, 2015. U.S. Fish and Wildlife Service, Leavenworth, Washington..

cannot be maintained by achieving an instream flow goal of 100 cfs, the LNFH would operate in a manner intended to maintain instream flow goals of 40 cfs in October, 60 cfs November - February, and 80 cfs in March in the Icicle Creek historical channel. Circumstances where the LNFH would need to deviate from the 100 cfs instream flow goal are described and analyzed in (Section 2.4.2.6.2, Table 26).

LONG-TERM OPERATIONS OF LNFH SURFACE WATER WITHDRAWAL

- LNFH is committed to changes in hatchery operations that contribute to the consistent achievement of an 100 cfs instream flow goal through the following actions:
 - LNFH will develop and evaluate plans for installation of a recirculating aquaculture system (RAS) to reduce the amount of surface water needed to meet salmon production targets established under the *U.S. v Oregon Agreement (U.S. v. Oregon 2009)*. It is expected that a RAS system could reduce water needs by at least 20 cfs. If successful, the unused portion of LNFH's surface water right would be placed in a water trust for purposes of instream flows. Implementation of this action is expected to enable greater operational flexibility for the hatchery to provide additional instream flow in Icicle Creek. The LNFH has developed design documents for a pilot RAS to be tested at the hatchery. Infrastructure improvements¹⁷ were completed in 2015 to allow this system to be put in place. [Personal communication with Bill Gale via phone, 2/28/17] We anticipate the pilot application of the RAS to begin within the next 3-4 years (Figure 2).
 - LNFH will continue to work cooperatively with other major water users in the Icicle Creek watershed through the IWG or another similar entity. Actions by LNFH alone are not likely to be sufficient to meet the instream flow goal of 100 cfs during all months of the year. Improvements and changes to the water delivery system(s) for the other major water users in Icicle Creek are also needed.

¹⁷ Infrastructure improvements include valve and pipeline replacement and repair.

LONG-TERM OPERATIONS OF STRUCTURE 2 FOR AQUIFER RECHARGE

- For over two years, LNFH has been pursuing options to replace the use of structure 2 for aquifer recharge. Ongoing feasibility studies are expected to be completed within one year. LNFH will identify a preferred option and implement this option within eight years, or sooner, if possible (Figure 2). The LNFH is considering the following alternatives¹⁸ for the replacement of the use of structure 2 for aquifer recharge:
 - The LNFH has requested the permitting of a new point of discharge from EPA (NPDES permit) and the WDOE (Clean Water Act 401 certification) to allow the pump back of LNFH effluent to the hatchery channel. A water quality study requested through the permitting process has been completed and submitted to the WDOE. Once all permitting is in place, absent other actions that obviate the need for aquifer recharge, LNFH will pursue implementation of this option.
 - The LNFH is conducting exploration work for the development of additional well resources and /or an infiltration gallery that would preclude the need to operate structure 2 for aquifer recharge. The results of these evaluations will be completed in the next year; potential solutions will be identified, and priority ranked for implementation.
 - In August and September of 2015, LNFH implemented an emergency effluent pump back evaluation for a system that was designed to recirculate clean effluent to the hatchery channel for aquifer recharge. [cite to **LNFH Pump Back Pilot Study report**] summarizes the results of the emergency effluent pump back evaluation and provides refined analysis of what would be needed to implement a permanent effluent pump back system to improve water supply to LNFH.
- Water diversions meet NMFS screen criteria (Y/N): No. The primary intake on the LNFH's point of diversion and water withdrawal system does not comply with NMFS's current screening criteria (NMFS 2011c). Both secondary screen chambers meet NMFS's earlier screening criteria (NMFS 1996). Although construction activities are not included in this proposed action, the surface water delivery system would be examined and upgraded or a new water delivery system at the LNFH would be completed within the next eight years that is expected to reduce impacts on ESA-listed fish. The primary diversion intake would be screened and, thus, would meet NMFS criteria for protecting anadromous salmonids (Irving 2012a). Fish salvage procedures have been developed to reduce effects to ESA-listed species, which are described in Section 2.4.2.6.1. The proposed action commits to screening the LNFH primary intake within eight years. Incidental take of ESA-listed spring Chinook salmon and steelhead associated with the water delivery system are described in sections 2.8.1.1 and 2.8.1.2 (Tables 31 and 32). Maintenance at the point of diversion (i.e., sluicing or dredging material from the conveyance channel, sand settling chamber, and fish ladder) causes a temporary increase in turbidity. These activities are conducted within the Water Quality Standards for Surface Water set by the WDOE (WAC 173-2011A). When the sand settling chamber is

¹⁸ Although preliminary stages of multiple projects can occur simultaneously, there is a limit to the number of capital improvement projects that can be implemented with certainty within a period of 8 years.

- 1 cleaned of sediment, water is drawn down and any fish entrained are netted and released
- 2 back into Icicle Creek.

Implementation Schedule for Infrastructure Improvements at LNFH¹⁹

Activity	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Feasibility Planning ¹ /NEPA Compliance ² Design, procurement, and construction plans, NEPA alternatives analysis								
Phase I – Groundwater Recharge Redesigned Well Field, Infiltration Gallery								
Phase II – Water Conservation RAS, pilot testing, full production								
Phase III – Surface Water Intake/Fish Screens/Plumbing ³								

¹ Feasibility study would include development of 30% designs and procurement plans to identify how best to implement Phases 1 through 3.

² Assumes Finding of No Significant Impact (FONSI) is appropriate level of NEPA compliance.

³ Since the aggregate benefit of the long-term LNFH infrastructure upgrades is greater than the installation of screens alone, and the infrastructure upgrades are likely to dictate what type of screening is required, this warrants additional time necessary to complete long-term infrastructure improvements and develop screening on the LNFH primary intake that complements the new water delivery system.

Figure 2. Proposed schedule for implementation of long-term actions for improving Icicle Creek instream flow conditions and the efficiency and reliability of hatchery water use (Irving 2015).

¹⁹ The implementation schedule allows for final design, procurement, and construction. Ability to proceed is subject to Congressional appropriations.

- Permanent or temporary barriers to juvenile or adult fish passage (Y/N): Yes. There is a rubble masonry diversion structure at RM 4.5 and two structures (Structures 2 and Structure 5) in the Icicle Creek historical channel at approximately RM 3.8 to 2.8, respectively, that may seasonally impede upstream passage to ESA-listed species. Structure 2 can alter the amount of wetted habitat in the Icicle Creek historical channel when operated by adjusting the radial gates. To increase the opportunity for upstream fish passage through both structures and improve habitat within the Icicle Creek historical channel, Structures 2 and 5 will remain open all year except during certain conditions²⁰ when, specifically:

(1) Returning adult spring Chinook salmon (50 or more) pass upstream of Structure 5 during broodstock collection (mid-May through June 24),

(2) Stream flow through the hatchery channel is not sufficient to promote pre-smolt emigration during juvenile release (late April),

(3) Stream flow in the hatchery channel is not sufficient to recharge the aquifer and hatchery well production is affected (late summer, fall, and early winter),

(4) High stream flows are endangering downstream infrastructure (during seasonal spring runoff and rain on snow events), or

(5) Maintenance of Structure 5 is being conducted.

When adjustments are made to Structures 2 and 5²¹, it would be done slowly and incrementally to avoid rapid water levels changes and prevent fish stranding (USFWS 2014). A stranded fish is any fish not in an area of water that is sufficiently connected to the mainstream channel (Cappellini 2014). Ramping rates would be conducted according to the WDOE Clean Water Act 401 certification process and would not exceed one inch per hour (WDOE 2010). Ramping rates may increase during emergency flood control actions but a rate has not been established for emergencies (Cappellini 2014). The Icicle Creek historical channel would be surveyed for fish after adjustments are made to Structures 2 (USFWS 2011). When making adjustments to Structures 2 and 5, USFWS also monitors turbidity through water sampling to ensure compliance with Water Quality Standards for Surface Waters (WAC 173-201A) (USFWS 2014).

In addition, LNFH shares a point of diversion with the Cascade Orchard Irrigation Company (COIC) at RM 4.5. Hatchery personnel would check the COIC upwelling chamber twice a day for entrained species (Cappellini 2012).

²⁰ As described in the USFWS LNFH Supplemental Biological Assessment NMFS. 2015. Endangered Species Act Section 7(a)(2) Consultation Biological Opinion And Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Consultation. Leavenworth National Fish Hatchery Spring Chinook Salmon Program Draft Adverse Modification to UCR Steelhead Critical Habitat Opinion and Associated RPA. National Marine Fisheries Service. West Coast Region. Sustainable Fisheries Division. Portland, Oregon. April 17, 2015..

²¹ Adjustments include raising or lowering gates at Structure 2, installing or removing flashboards or weirs at Structure 5.

- Instream structures (Y/N): Yes. There is an entrance to the fish ladder at RM 2.8, a fish ladder at the low dam at RM 4.5, and a water return via pipeline (below the fish ladder) at RM 4.5.
- Stream bank armoring or alterations (Y/N): Yes. Streambank armoring may be necessary at three locations: (1) Structure 1 and 2; (2) water return; and (3) the entrance to the fish ladder to the adult broodstock ponds. In the past, the area from below the LNFH spillway structure to approximately 500 feet downstream required stream bank restoration after a flooding event undermined the LNFH adult fish ladder and nearly breached the pollution abatement pond. This area may require stream bank repair, as well as at the LNFH diversion structure (RM 4.5), if affected by future flooding (Cappellini 2014). No construction activities are included in the proposed action. Any stream bank armoring or alterations would be analyzed under a separate ESA consultation.

- Pollutant discharge and location(s): Yes. All water diverted into LNFH water delivery system is eventually discharged into Icicle Creek (minus any leakage or evaporation) at one of three locations, including the:

(1) Base of the fish ladder (Outfall 001; RM 2.8);

(2) Top of the fish ladder (Outfall 004; for approximately one week during pre-smolt release to facilitate hatchery fish emigration);

(3) Pumped/piped fish release (Outfall 005; for approximately one to two weeks during pre-smolt release to facilitate hatchery fish emigration; when Outfall 005 is in operation, the discharge from Outfall 001 is reduced by the amount released at Outfall 005); and

(3) Outfall for the pollution abatement ponds (Outfall 002; RM 2.7) {USFWS, 2011 #55}.

The majority of river and well water used for hatchery operations is returned to Icicle Creek near the base of the adult return ladder, except during pond cleaning and maintenance activities when all water is routed through the pollution abatement ponds {USFWS, 2011 #55}. The LNFH complies with several water rights associated with Icicle Creek, Snow and Nada Lakes, and the seven wells located on the property. Maintenance of water diversions includes sediment removal of LNFH's intake conveyance channel and intake building sump via surface elevation. Maintenance of the water supply reservoirs includes twice-a-year service of flow gages, debris removal, and safety inspections. Maintenance of the pollution abatement ponds includes cleaning and sediment disposal via WDOE and EPA standards.

The LNFH operates and monitors its water discharge in compliance with its National Pollutant Discharge Elimination System (NPDES) Permit No. WA-000190-2. In November 2005, the LNFH submitted an application to the EPA for a new NPDES discharge permit. A draft permit was developed by the EPA in December 2010; however, through the review process it was determined that the LNFH had made significant changes to its operations since the 2005 submittal for a NPDES permit and a new permit application would need to be submitted to address these changes. Changes included

hatchery modifications to reflect actions to improve the health of the hatchery's spring Chinook salmon and to improve the water quality (i.e., lower phosphorus levels) discharged into Icicle Creek. Changes include, but are not limited to the:

(1) Reduction in hatchery production from 1,625,000 to 1,200,000 million spring Chinook salmon;

(2) Use of low phosphorus feed (when commercially available) during the critical months of March, April, July, August, and September (with the exception of fry in the nursery); and

(3) Construction and operation of a second pollution abatement pond, which was completed in 2010.

The LNFH submitted this new NPDES application to the EPA in October 2011. In conjunction with the EPA's 2005 draft NPDES permit, the WDOE issued a Clean Water Act (CWA) 401 Certification {WDOE, 2010 #81} to the LNFH. The WDOE did not terminate this certification when EPA terminated its' associated 2005 draft NPDES permit (EPA 2010). However, the LNFH submitted a new CWA 401 certification application to address significant changes to hatchery operations to the WDOE in October 2011.

In 2013, the USFWS completed two reports for the Final 401 CWA Certification Order No. 7192: (1) Icicle Creek instream flow and fish habitat analysis (Skalicky et al. 2013); and (2) Icicle Creek fish passage evaluation for the LNFH (Anglin et al. 2013).

In October 2016, EPA proposed a new NPDES permit. Under this new NPDES permit, the LNFH would discharge effluent into Icicle Creek at a standard that is more stringent than the pollutant levels analyzed in the 2015 Opinion; NMFS recognizes that the permit conditions are subject to change because the proposed permit is still in its draft stage, but NMFS analyzes the likely effects of the permit issuance as proposed. As proposed, the permit would allow discharge into Icicle Creek at Outfalls 001, 002, 004, and 005, with Outfall 003 listed for potential future use; in addition, the draft permit includes a new discharge location (Outfall 006, located at ~RM 3.3) in the hatchery channel of Icicle Creek. If permitted and feasible, this newly proposed discharge location would be used to pump-back hatchery water to the hatchery channel for aquifer recharge. Final decisions on both permit applications are still pending. In the interim, the LNFH continues to operate and monitor its water discharge in accordance with NPDES Permit No. WA-000190-2.

1.4. Action Area

The "Action Area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area includes the Wenatchee Basin, including Icicle Creek (Figure 3). The action area also includes the Entiat Basin where LNFH adult strays have been encountered at a low rate and may spawn naturally.

The operation of hatchery facilities has the potential to affect ESA-listed spring Chinook salmon and steelhead in Icicle Creek through the diversion of surface water or the maintenance of instream structures (e.g., the water intake and discharge structures) and the release of effluent. Under the proposed action, the hatchery facilities would be used to spawn, incubate, and rear spring Chinook salmon for the LNFH program, which includes:

- Leavenworth National Fish Hatchery (ground and facilities)
- LNFH fish ladder and broodstock holding ponds
- Primary intake and low head dam (i.e., Structure 1) and associated water intake system²²
- Hatchery Channel (i.e., aquifer for hatchery well recharge)
- Historical Channel (i.e., Structure 2 water control feature for hatchery well recharge)
- Structure 5
- Snow/Nada Lakes Supplementation Reservoir

The action area includes the hatchery facilities/structures listed above (Figure 3) and portions of Icicle Creek where water withdrawals are affecting ESA-listed species through sediment transport, increased water temperatures, etc. (e.g., water diversions, maintenance activities).

NMFS considered whether the mainstem Columbia River, the estuary, and the ocean should be included in the action area but the effects analysis was unable to detect or measure effects of the proposed action beyond the area described above, based on best available scientific information (Section 2.4.2.4)(NMFS 2009a).

²² This includes the shared intake between LNFH and the COIC, grizzly rack, pipeline, sand settling chamber, etc.

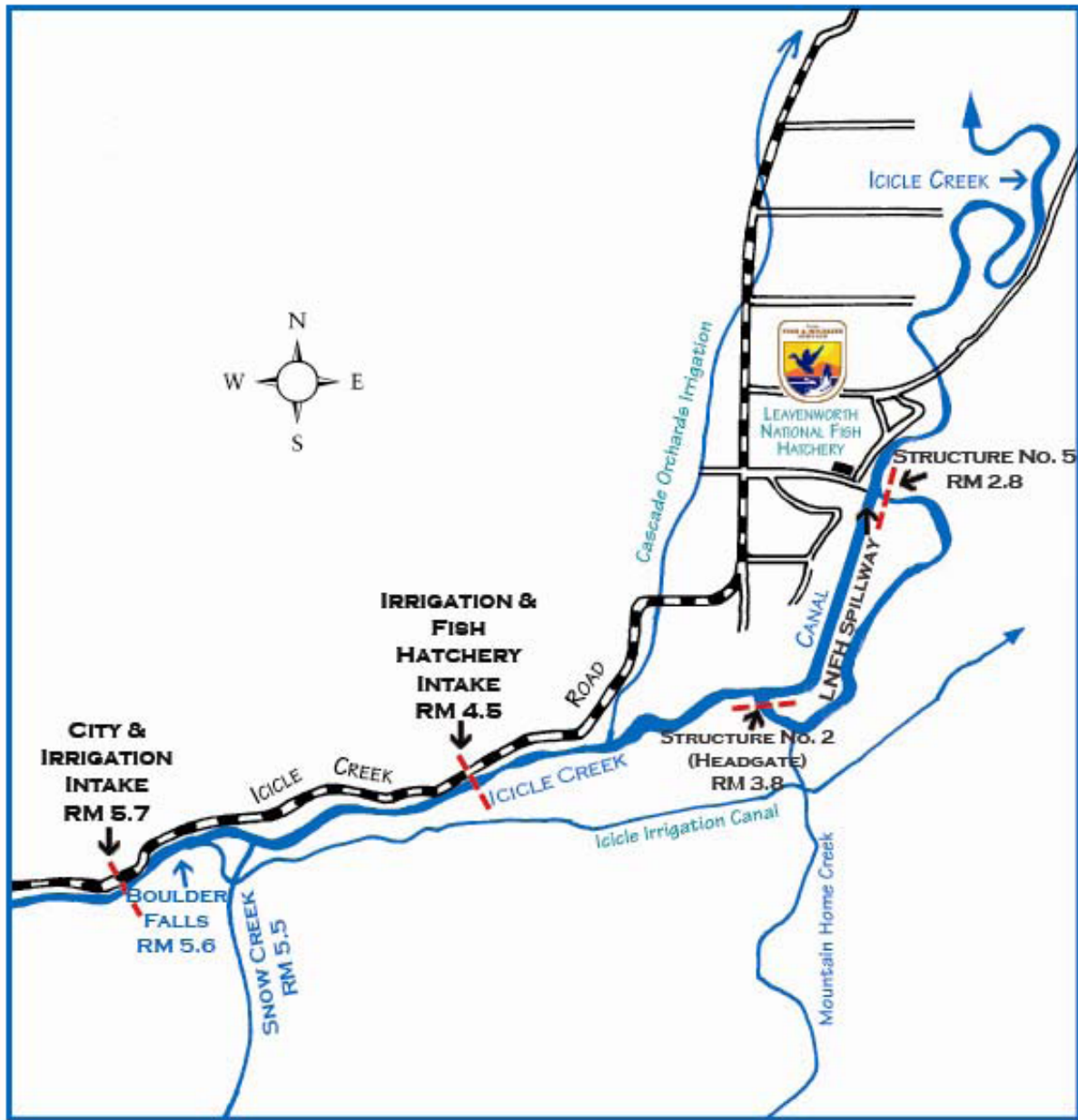


Figure 3. Leavenworth National Fish Hatchery and Vicinity {USFWS, 2004 #3433}.

ESA-listed species in the action area that may be affected by the proposed action include UCR Chinook salmon and UCR steelhead (Table 2). The action area is used by both UCR spring Chinook salmon and UCR steelhead. UCR spring Chinook salmon critical habitat is designated in the upper and lower mainstem Wenatchee River, including tributaries above Tumwater Dam that serve as major migration, spawning, and rearing areas for adults and juveniles but not tributaries below Tumwater Dam, such as Icicle Creek (NMFS 2005a). UCR steelhead critical habitat is designated in the upper Wenatchee River and lower mainstem areas as well as tributaries above and below Tumwater Dam, including in Icicle Creek, that serve as major

migration, spawning, and rearing areas for adults and juveniles (NMFS 2005a). The action area is also designated as essential fish habitat (EFH) for Chinook and coho salmon (PFMC 2003).

Table 2. Federal Register notices for the final rules that list species, designate critical habitat, or apply protective regulations to ESA listed species considered in this consultation.

Species	Listing Status	Critical Habitat	Protective Regulations
Chinook salmon (<i>Oncorhynchus tshawytscha</i>)			
Upper Columbia River spring-run	Endangered 70 FR 37160; June 28, 2005	70 FR 52630; Sept 2, 2005	Not applicable ²³
Steelhead (<i>Oncorhynchus mykiss</i>)			
Upper Columbia River steelhead	Threatened 71 FR 834; January 5, 2006	70 FR 52630; Sept 2, 2005	71 FR 5178; February 1, 2006

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, Federal agencies must ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provides an opinion stating how the agency's actions would affect listed species and their critical habitat. If incidental take is expected, section 7(b)(4) requires NMFS to provide an incidental take statement (ITS) that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures and terms and conditions to minimize such impacts.

2.1. Analytical Approach--Overview

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "to jeopardize the continued existence of a listed species," which is "to engage in an action that would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

For its critical habitat analysis, this biological opinion relies on the definition of "destruction or adverse modification," which is "a direct or indirect alteration that appreciably diminishes the

²³ For Endangered species, Section 9 prohibitions apply automatically.

value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features” (81 FR 7214, February 11, 2016).

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

Identify the range-wide status of the species and critical habitat

This section describes the status of species and critical habitat that are the subject of this opinion. The status review starts with a description of the general life history characteristics and the population structure of the ESU/DPS, including the strata or major population groups (MPG) where they occur. NMFS has developed specific guidance for analyzing the status of salmon and steelhead populations in a “viable salmonid populations” (VSP) paper (McElhany et al. 2000). The VSP approach considers four attributes, the abundance, productivity, spatial structure, and diversity of each population (natural-origin fish only), as part of the overall review of a species’ status. For salmon and steelhead protected under the ESA, the VSP criteria therefore encompass the species’ “reproduction, numbers, or distribution” (50 CFR 402.02). In describing the range-wide status of listed species, NMFS reviews available information on the VSP parameters including abundance, productivity trends (information on trends, supplements the assessment of abundance and productivity parameters), spatial structure, and diversity. We also summarize available estimates of extinction risk that are used to characterize the viability of the populations and ESU/DPS, and the limiting factors and threats. To source this information, NMFS relies on viability assessments and criteria in technical recovery team documents, ESA Status Review updates, and recovery plans. We determine the status of critical habitat by examining its physical and biological features (also called “primary constituent elements” or PCEs²⁴). Status of the species and critical habitat are discussed in Section 2.2

Describe the environmental baseline

The environmental baseline includes the past and present impacts of Federal, state, or private actions and other human activities *in the action area* on ESA-listed species. It includes the anticipated impacts of proposed Federal projects that have already undergone formal or early section 7 consultation and the impacts of state or private actions that are contemporaneous with the consultation in process. The environmental baseline is discussed in Section 2.3 of this opinion.

Analyze the effects of the proposed action on both species and their habitat

²⁴ The new critical habitat regulations (81 FR 7414) replace this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a “destruction or adverse modification” analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PCE to mean PBF or essential feature, as appropriate for the specific critical habitat.

In this section, NMFS analyzes the Proposed Action in terms of effects the Proposed Action would be expected to have on ESA-listed species and on designated critical habitat, based on the best scientific information available. A Proposed Action is analyzed for beneficial, neutral, and adverse effects on ESA-listed species by assessing the effects on four key parameters or attributes (abundance, productivity, spatial structure, and diversity). For hatchery programs, the analysis is broken down into seven factors, which are discussed in more detail in Section 2.4.1.

Describe the cumulative effects in the action area

Cumulative effects, as defined in NMFS' implementing regulations (50 CFR 402.02), are the effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area. Future Federal actions that are unrelated to the Proposed Action are not considered because they require separate section 7 consultation. Cumulative effects are considered in Section 2.5 of this opinion.

Integrate and synthesize the above factors

Integration and synthesis of information from previous sections occurs in Section 2.6 of this opinion. In this step, NMFS adds the expected effects of the Proposed Action (Section 2.4) on the status of ESA protected populations in the Action Area under the environmental baseline (Section 2.3) and to cumulative effects (Section 2.5), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) result in appreciable reductions in the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) result in a direct or indirect alteration that appreciably diminishes the value of critical habitat for the conservation of a listed species. Such alterations may include, but are not limited to, those that alter the physical or biological features essential to the conservation of a species or that preclude or significantly delay development of such features. Impacts on individuals within the affected populations are analyzed to determine their effects on the VSP parameters for the affected populations, and these are combined with the overall status of the stratum/MPG to determine the effects on the ESA-listed species (ESU/DPS).

Reach a conclusion about whether species are jeopardized or critical habitat is adversely modified

Based on the Integration and Synthesis analysis in Section 2.6 the opinion determines whether the Proposed Action is likely to jeopardize ESA protected species or destroy or adversely modify designated critical habitat in Section 2.7.

If necessary, suggest a reasonable and prudent alternative to the Proposed Action

If NMFS determines that the action under consultation is likely to jeopardize the continued existence of listed species or destroy or adversely modify designated critical habitat, NMFS must identify an RPA or RPAs to the Proposed Action.

2.2. Range-wide Status of the Species and Critical Habitat

This opinion examines the status of each species (as defined below) that would be affected by the Proposed Action. The species and the designated critical habitat that are likely to be affected by the Proposed Action, and any existing protective regulations, are described in Table 7. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. The species status section helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the current function of the essential physical and biological features that help to form that conservation value.

"Species" Definition: The ESA of 1973, as amended, 16 U.S.C. 1531 et seq. defines "species" to include any "distinct population segment (DPS) of any species of vertebrate fish or wildlife which interbreeds when mature."

To identify DPSs of salmon species, NMFS follows the "Policy on Applying the Definition of Species under the ESA to Pacific Salmon" (56 FR 58612). Under this policy, a group of Pacific salmon is considered a distinct population, and hence a "species" under the ESA if it represents an evolutionarily significant unit (ESU) of the biological species. The group must satisfy two criteria to be considered an ESU: (1) It must be substantially reproductively isolated from other con-specific population units; and (2) It must represent an important component in the evolutionary legacy of the species. For example, UCR Chinook salmon constitutes an ESU of the taxonomic species *O.s tshawytscha* and therefore is considered a "species" under the ESA.

To identify DPSs of steelhead, NMFS applies the joint FWS-NMFS DPS policy (61 FR 4722). Under this policy, a DPS of steelhead must be discrete from other populations, and it must be significant to its taxon. For example, the UCR steelhead constitute a DPS of the taxonomic species *O. mykiss* and is considered a "species" under the ESA.

2.2.1. Status of Listed Species

A population is a group of individuals of a single species inhabiting a specific area. As described above, NMFS commonly uses: spatial structure, diversity, abundance, and productivity as parameters to assess the viability of the populations that, together, constitute the species (McElhany et al. 2000). When these parameters are collectively at appropriate levels, they maintain a population's capacity to adapt to various environmental conditions and allow it to sustain itself in the natural environment. These attributes are influenced by survival, behavior, and experiences throughout a species' entire life cycle, and these characteristics, in turn, are influenced by habitat and other environmental conditions.

"Abundance" generally refers to the number of naturally-produced adults (i.e., the progeny of naturally-spawning parents) in the natural environment (e.g., on spawning grounds).

“Productivity,” as applied to viability factors, refers to the number of individuals produced during a fish’s entire life cycle; i.e., the number of naturally-spawning adults produced per their naturally spawning parental pair. When the number of progeny replaces or exceeds the number of parents, a population is stable or increasing. When the number of progeny fail to replace the number of parents, the population is declining. McElhany et al. (2000) use the terms “population growth rate” and “productivity” interchangeably when referring to reproduction over the entire life cycle. They also refer to “trend in abundance,” which is the manifestation of long-term population growth rate.

“Spatial structure” refers both to the spatial distributions of individuals in the population and the processes that generate that distribution. A population’s spatial structure depends fundamentally on quality and spatial configuration of habitat and the dynamics and dispersal characteristics of individuals in the population.

“Diversity” refers to the distribution of traits within and among populations. These range in scale from DNA sequence variation at single genes to complex life history traits (McElhany et al. 2000).

For species with multiple populations, once the biological status of a species’ populations has been determined, NMFS assesses the status of the entire species using criteria for groups of populations, as described in recovery plans and guidance documents from technical recovery teams. Considerations for species viability include having multiple populations that are viable, ensuring that populations with unique life histories and phenotypes are viable, and that some viable populations are both widespread, to avoid concurrent extinctions from mass catastrophes, and spatially close, to allow functioning as metapopulations (McElhany et al. 2000).

One factor affecting the status of ESA-listed species, considered in this opinion and aquatic habitat at large, is climate change. Climate change affects salmon and their habitat throughout Washington State. This topic is discussed in more detail in Section 2.2.3, Climate Change.

The summaries that follow describe the status of the two ESA-listed species that occur within the action area considered in this opinion and their designated critical habitats. More detailed information on the status and trends of these listed resources, and their biology and ecology, are in the listing regulations and critical habitat designations published in the Federal Register (Table 2).

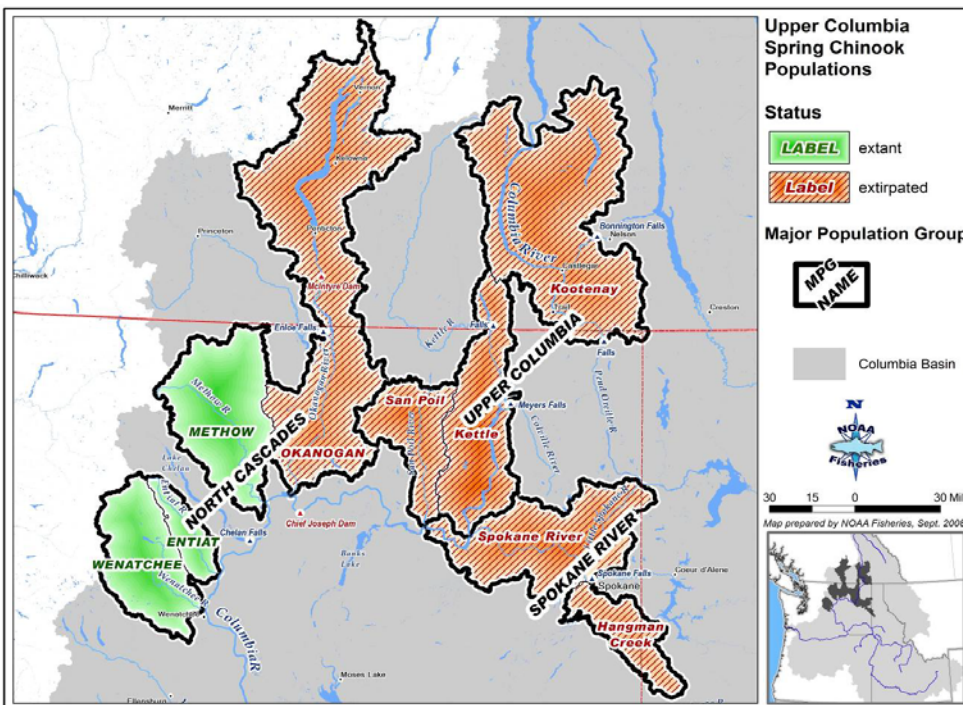
2.2.1.1. Life History and Status of UCR Chinook Salmon

Chinook salmon (*Oncorhynchus tshawytscha*) have a wide variety of life history patterns that include: variation in age at seaward migration; length of freshwater, estuarine, and oceanic residence; ocean distribution; ocean migratory patterns; and age and season of spawning migration. Two distinct races of Chinook salmon are generally recognized: “stream-type” and “ocean-type” (Healey 1991; Myers et al. 1998). ESA-listed UCR spring Chinook salmon are stream-type. Stream-type Chinook salmon spend 2 to 3 years in coastal ocean waters, and enter freshwater in February through April; adults return to the Wenatchee River during late March through early May and peak spawning occurs from August through September. Spring Chinook salmon also spawn and rear high in the Wenatchee watershed and reside in freshwater for a year

before migrating downstream. Very little ocean harvest occurs for UCR spring Chinook salmon (NMFS 2008b).

Genetic differences exist between this ESU and others containing stream-type fish but the ESU boundary was defined using ecological differences in spawning and rearing habitat (Myers et al. 1998). The Grand Coulee Fish Maintenance Project (1939 through 1943) may have had a major influence on this ESU because fish from multiple populations were mixed into one relatively homogenous group and redistributed into streams throughout the UCR region (NMFS 2004a).

Figure 4. Upper Columbia River Spring Chinook Salmon ESU (ICTRT 2008).



Abundance, Productivity, Spatial Structure, and Diversity

Status of the species is determined based on the abundance, productivity, spatial structure, and diversity of its constituent natural populations. Best available information indicates that the species, in this case the UCR spring Chinook salmon ESU, is at high risk and remains at endangered status (Table 3) (NWFSC 2015). The UCR spring-run Chinook salmon ESU is not currently meeting the viability criteria (adopted from the Interior Columbia Basin Technical Recovery Team (ICTRT)) in the Upper Columbia Spring Chinook Salmon and Steelhead Recovery Plan (NWFSC 2015).

Returns of UCR spring Chinook to the CR mouth in the 1980s averaged around 20,300 adults (37% natural origin). Returns declined severely during the 1990s averaging 9,500 adults (20% natural origin). During the early 2000s, the annual returns improved, averaging 21,500 adults (e.g., 2,200 natural origin fish; 10% natural origin). ODFW and WDFW (2015) reported that the UCR natural origin component was 133% of the recent 10-year average (2,300 fish) and represented 17% of the 2014 UCR spring Chinook salmon adult total run (hatchery and natural combined) in 2014.

For the most recent period (2005-2014), abundance has increased for all three populations, but productivity for all three populations remains below replacement (Table 3). Possible contributing factors include density dependent effects, differences in spawning distribution relative to habitat quality, and reduced fitness of hatchery-origin spawners. For spatial structure and diversity, there is a consistent and substantial decline in the proportion of natural-origin fish on the spawning grounds for all three populations. Natural-origin fish now make up fewer than fifty percent of the spawners for all three populations (Table 4).

Although increases in natural-origin abundance relative to the extremely low levels observed during the mid-1990s are encouraging, overall productivity has decreased to extremely low levels for the two largest populations (Wenatchee and Methow). The predominance of hatchery fish on the spawning grounds, particularly for the Wenatchee and Methow populations, is an increasing risk, and populations that rely on hatchery spawners are not viable (McElhany et al. 2000). Based on the combined ratings for abundance/productivity and spatial structure/diversity, all three extant populations and the ESU remain at high risk of extinction (Figure 5; Table 3).

Table 3. Risk levels and viability ratings for natural-origin UCR spring Chinook salmon populations from 2005-2014 (NWFSC 2015).

Population	Abundance and Productivity (A/P)				Spatial Structure and Diversity (SS/D)			Overall Risk
	Minimum Abundance Threshold	Spawning Abundance	Productivity	A/P Risk	Natural Processes Risk	Diversity Risk	SS/D Risk	
Wenatchee River	2000	545 (311-1030)	0.60	High	Low	High	High	High
Entiat River	500	166 (78-354)	0.94	High	Moderate	High	High	High
Methow River	2000	379 (189-929)	0.46	High	Low	High	High	High

The integrated spatial structure and diversity risk ratings for all three populations in this ESU are at “high” risk. The spatial processes component is “low” for the Wenatchee River and Methow River populations and “moderate” for the Entiat River (loss of production in the lower section increases effective distance to other populations). All three of the populations in this ESU are at “high” risk for diversity, driven primarily by chronically high proportions of hatchery-origin spawners (26% to 76%) in natural spawning areas and lack of genetic diversity among the natural-origin spawners (NWFSC 2015). This effect is particularly high in the Wenatchee and Methow populations with hatchery-origin spawners composing 65% and 76%, respectively (NWFSC 2015). The high proportion of hatchery-origin spawners reflects the large increase in releases from the directed supplementation programs in those two drainages. While a high number of hatchery-origin releases occurred in the past, according to long-term Habitat Conservation Plans (HCPs) in the UCR Basin, hatchery production levels were adjusted (i.e., lowered) in 2013 and similar readjustment would occur every 10 years thereafter to achieve no net impact (NNI) on natural origin populations (see Section 2.3, Environmental Baseline). In regard to non-listed spring Chinook salmon production from the LNFH spring Chinook hatchery

program was reduced by 26% (1.625 to 1.2 million) in the Wenatchee Basin since 2008 (Section 2.3). In regard to ESA-listed spring Chinook salmon, in 2013, production from the Chiwawa spring Chinook salmon supplementation program was reduced by 52% (i.e., from 298,000 to 144,026) in the Wenatchee Basin. The Entiat NFH spring Chinook salmon program was terminated in 2007 because of potential effects to natural-origin spring Chinook salmon, and hatchery fish on the spawning grounds in the Entiat Basin are expected to decline. The Nason Creek program began production in the Wenatchee Basin for about 150,000 spring Chinook salmon smolt release (Grant County PUD et al. 2009), and the White River spring Chinook salmon program (for 150,000 smolt release) was terminated in 2013 [cite to letter of termination from Amilee].

For spatial structure and diversity, there is a consistent and substantial decline in the proportion of natural-origin fish on the spawning grounds for the Wenatchee population. Natural-origin fish now make up fewer than fifty percent of the spawners (Table 4). Spring Chinook salmon occurring in the action area are the Wenatchee River and Entiat River populations. Natural-origin spawners are what NMFS considers in population viability and ESU status determinations.

Table 4. Estimates of the percent natural-origin spawners for UCR spring Chinook salmon populations (NWFSC 2015).

Population	% Natural-origin (5-year average)			
	1995 to 1999	2000 to 2004	2005 to 2009	2010-2014
Wenatchee River	66	54	24	35
Entiat River	70	56	47	74
Methow River	61	16	24	27

The UCR recovery plan (UCSRB 2007) calls for improvement in each of the three extant spring Chinook salmon populations (no more than a 5% risk of extinction in 100 years) and for a level of spatial structure and diversity that restores the distribution of natural populations to previously occupied areas and allows natural patterns of genetic and phenotypic diversity to be expressed. This corresponds to a threshold of at least “viable” status for each of the three natural populations. Based on the combined ratings for abundance/productivity and spatial structure/diversity, all three extant populations and the ESU remain at high risk of extinction (Figure 5).

		Risk for Spatial Structure / Diversity			
		Very Low	Low	Moderate	High
Risk for Abundance/Productivity	Very Low (<1%)	Highly Viable	Highly Viable	Viable	Maintained
	Low (1-5%)	Viable	Viable	Viable	Maintained
	Moderate (6-25%)	Maintained	Maintained	Maintained	High
	High (>25%)	High	High	High	High: Wenatchee Entiat Methow

Figure 5. Matrix used to assess population status across VSP parameters for UCR spring Chinook salmon. Percentages for abundance and productivity scores represent the probability of extinction in a 100-year time period (NWFSC 2015).

2.2.1.2. Life History and Status of UCR Steelhead

Steelhead (*O. mykiss*) occur as two basic anadromous run types based on the level of sexual maturity at the time of river entry and the duration of the spawning migration (Burgner et al. 1992). The stream-maturing type (inland), or summer steelhead, enters freshwater in a sexually immature condition and requires several months in freshwater to mature and spawn. The ocean-maturing type (coastal), or winter steelhead, enters freshwater with well-developed gonads and spawns shortly after river entry (Barnhart 1986).

UCR steelhead are summer steelhead, which return to freshwater between May and October, and require up to 1 year in freshwater to mature before spawning (Chapman et al. 1994). A portion of the returning run overwinters in the mainstem reservoirs, passing over the Upper Columbia River dams in April and May of the following year. Spawning occurs between January and June. In general, summer steelhead prefer smaller, higher-gradient streams relative to other Pacific salmon, and they spawn farther upstream than winter steelhead (Behnke and American Fisheries Society 1992; Withler 1966). Progeny typically reside in freshwater for two years before migrating to the ocean, but freshwater residence can vary from 1-7 years (Peven et al. 1994). For UCR steelhead, marine residence is typically one year, although the proportion of two-year ocean fish can be substantial in some years. They migrate directly offshore during their first summer rather than migrating nearer to the coast as do salmon. During fall and winter, juveniles move southward and eastward (Hartt and Dell 1986).

The UCR Steelhead DPS includes all naturally spawned steelhead populations below natural and man-made impassable barriers in streams in the Columbia River Basin upstream of the Yakima River, Washington to the U.S. – Canada border. The UCR Steelhead DPS also includes six artificial propagation programs: the Wenatchee River, Wells Hatchery (in the Methow and Okanogan rivers), Winthrop NFH, Omak Creek, and the Ringold steelhead hatchery programs.

The UCR Steelhead DPS consisted of three MPGs before the construction of Grand Coulee Dam, but it is currently limited to one MPG with four extant populations: Wenatchee, Methow, Okanogan, and Entiat. A fifth population in the Crab Creek drainage is believed to be

functionally extinct. What remains of the DPS includes all naturally spawned populations in all tributaries accessible to steelhead upstream from the Yakima River in Washington State, to the U.S. – Canada border (Figure 6). The proposed LNFH spring Chinook salmon hatchery program may affect the Wenatchee River and Entiat River steelhead populations through various ecological and genetic effects (Section 2.4.2) since LNFH-origin adults are encountered upstream in the Wenatchee River at Tumwater Dam and in the Entiat River (Cooper 2014; Ford 2011; Hall 2014).

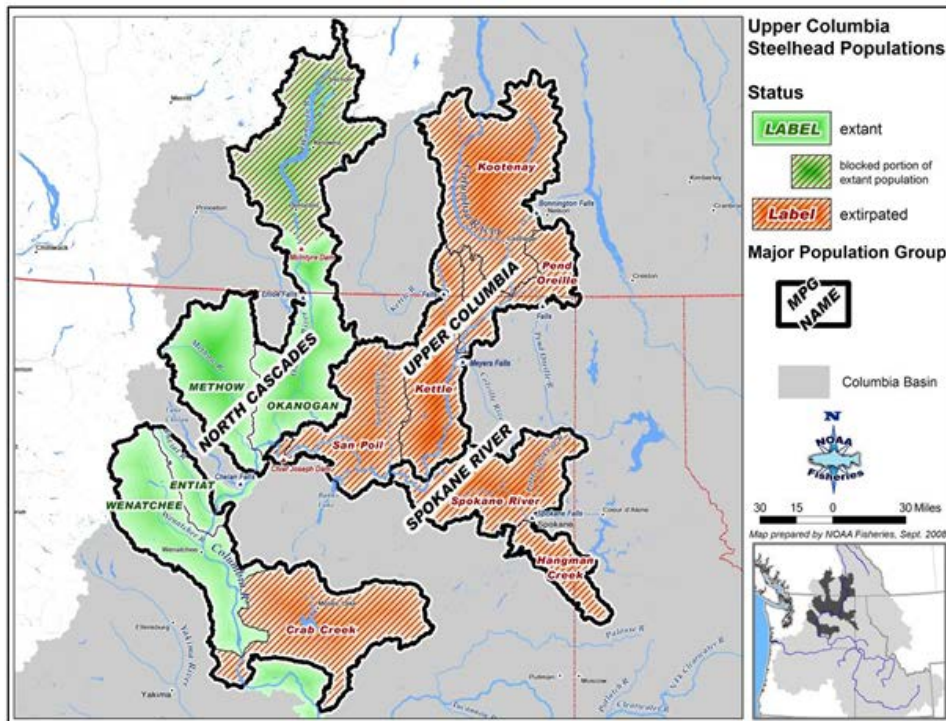


Figure 6. Upper Columbia River steelhead DPS (ICTRT 2008).

Abundance, Productivity, Spatial Structure, and Diversity

Status of the species is determined based on the abundance, productivity, spatial structure, and diversity of its constituent natural populations. Best available information indicates that the UCR Steelhead DPS is at high risk and remains at threatened status (Table 5)(NWFSC 2015).

For the 2005-2014 period, abundance has increased for natural-origin spawners in each of the four extant populations (Table 5). Annual returns (ESA-listed hatchery and natural origin fish combined) have also increased relative to returns for the 5-year period reported in the 2005 BRT review (Good et al. 2005); however, natural-origin returns remain well below target levels for three of the four populations. Productivity remained the same for three of the four populations and decreased for the Entiat population relative to the last review (NWFSC 2015). For spatial structure and diversity, hatchery-origin returns continue to constitute a high fraction (Table 6) of total spawners in natural spawning areas for the DPS as a whole (NWFSC 2015). The predominance of hatchery fish on the spawning grounds is an increasing risk, and populations that rely solely on hatchery spawners are not viable over the long-term (McElhany et al. 2000).

Table 5. Risk levels and viability ratings for natural-origin UCR steelhead populations from 2005-2014 (NWFSC 2015).

Population	Abundance and Productivity (A/P)				Spatial Structure and Diversity (SS/D)			Overall Risk
	Minimum Abundance Threshold	Spawning Abundance	Productivity	A/P Risk	Natural Processes Risk	Diversity Risk	SS/D Risk	
Wenatchee River	1000	1025 (386-2235)	1.207	Low	Low	High	High	Maintained
Entiat River	500	146 (59-310)	0.434	High	Moderate	High	High	High
Methow River	1000	651 (365-1105)	0.371	High	Low	High	High	High
Okanogan River	750	189 (107-310)	0.154	High	High	High	High	High

The integrated spatial structure and diversity risk ratings for all four populations of UCR steelhead are at “high” risk (Table 5), including the Wenatchee population. These ratings are largely driven by chronic high levels of hatchery spawners (42% to 87%) within natural spawning areas and lack of genetic diversity among the populations (NWFSC 2015)(Table 6). The relative effectiveness of hatchery-origin spawners and the long-term impact on productivity of high levels of hatchery contribution to natural spawning are key uncertainties for these populations. The modest improvements in natural origin returns in recent years are primarily the result of several years of relatively good survival in the ocean and tributary habitats. For the Wenatchee steelhead population, there is an increase in the proportion of natural-origin fish on the spawning grounds from 1991 to 2014, and natural-origin fish now make up over fifty percent of the spawners in this basin (Table 6). Based on the combined ratings for abundance/productivity and spatial structure/diversity, three of the four extant populations and the DPS remain at high risk of extinction. Hatchery-origin steelhead included in the action area are the Wenatchee River and Entiat River populations.

Table 6. Estimates of the percent natural-origin spawners for UCR spring Chinook salmon populations (NWFSC 2015).

Population	% Natural-origin (5-year average)			
	1995 to 1999	2000 to 2004	2005 to 2009	2010-2014
Wenatchee River	41	34	38	58
Entiat River	21	24	24	31
Methow River	14	11	15	24
Okanogan River	5	6	9	13

The ESA Recovery Plan (UCSRB 2007) for UCR steelhead calls for improvement in each of the four extant steelhead populations (no more than a 5 percent risk of extinction in 100 years) and for a level of spatial structure and diversity that restores the distribution of natural populations to previously occupied areas and allows natural patterns of genetic and phenotypic diversity to be expressed. This corresponds to a threshold of at least “viable” status for each of the three natural populations, which falls into the category of “high risk” (Figure 7).

Although increases in steelhead total abundance (natural and hatchery fish; Table 5) relative to the extremely low levels observed during the mid-1990s are encouraging, overall productivity has decreased to extremely low levels for the natural-origin steelhead population; however, the recent increase of the Wenatchee population production to greater than 1 is encouraging. The predominance of hatchery fish on the spawning grounds, particularly for the Methow and Okanogan River populations, is an increasing risk. Based on the combined ratings for abundance/productivity and spatial structure/diversity, all four extant populations, including the Wenatchee population, have a high risk of extinction in the next 100 years (Figure 7).

		Risk for Spatial Structure / Diversity			
		Very Low	Low	Moderate	High
Risk for Abundance / Productivity	Very Low (<1%)	Highly Viable	Highly Viable	Viable	Maintained
	Low (1-5%)	Viable	Viable	Viable	Maintained: Wenatchee
	Moderate (6-25%)	Maintained	Maintained	Maintained	High
	High (>25%)	High	High	High	High: Entiat Methow Okanogan

Figure 7. Matrix used to assess population status across VSP parameters for UCR steelhead. Percentages for abundance and productivity scores represent the probability of extinction in a 100-year time period (NWFSC 2015) (ICTRT 2007b).

Limiting factors for both species

Both the UCR spring-run Chinook salmon and steelhead populations continue to experience many problems that limit their abundance, productivity, spatial structure, and diversity. The primary factors limiting these species' persistence include (Ford 2011; UCSRB 2007):

- (1) Degradation and loss of estuarine areas that help the fish survive the transition between fresh and marine waters;
- (2) Altered flood plain connectivity and function;
- (3) Spawning and rearing areas that have riparian degradation and altered channel structure and complexity²⁵;
- (4) Reduced stream flow;
- (5) Predation by native and non-native species;
- (6) Harvest; and

Interbreeding and competition between hatchery fish and fish from natural populations.

Recovery Criteria for UCR Spring-run Chinook and UCR Steelhead

The ICTRT (2007) developed specific biological viability criteria based on the VSP concept (McElhany et al. 2000) at the natural population, MPG, and at the ESU/DPS scales. At the population scale, the ICTRT recommended specific biological criteria based on the four viability components of VSP: abundance, productivity, spatial structure, and diversity (Table 3 and Table 5). These criteria are integrated to develop a total population viability rating and de-listing

²⁵ This includes deep pools, cover, large wood recruitment, side-channel refuge areas, and high quality spawning gravels.

criteria (Table 7 and Table 9). The population viability ratings, in order of descending risk, are highly viable, viable, maintained, and high risk (Figure 5 and Figure 7).

In 2007, NMFS adopted a recovery plan for UCR spring-run Chinook salmon and UCR steelhead developed by the Upper Columbia Salmon Recovery Board (UCSRB 2007). The Upper Columbia Salmon Recovery Plan’s overall goal is “to achieve recovery and delisting of spring chinook salmon and steelhead by ensuring the long-term persistence and viable populations of naturally produced fish distributed across their native range.” This plan incorporated the ICTRT viability goals as biological delisting criteria (UCSRB 2007). The recovery strategies outlined in the recovery plan are targeted to achieve, at a minimum, the biological criteria for each ESU/DPS.

The UCR Spring-run Chinook Salmon Biological Recovery Criteria (Table 7):

- Criterion 1: The 12-year geometric mean for abundance and productivity of naturally produced spring-run Chinook salmon within the Wenatchee, Entiat, and Methow populations must reach a level that would have no more than a 5 percent extinction-risk (viability) over a 100-year period.
- Criterion 2: At a minimum, the UCR spring-run Chinook salmon ESU will maintain at least 4,500 naturally produced spawners and a spawner-to-spawner ratio greater than 1.0 distributed among the three populations²⁶.
- Criterion 3: Over a 12-year period, naturally produced spring Chinook salmon will use currently occupied major spawning areas (minor spawning areas are addressed primarily under Criteria 4 and 5) throughout the ESU according to population-specific criteria outlined in the Recovery Plan²⁷.
- Criterion 4: The mean score for the three metrics of natural rates and levels of spatially mediated processes (Goal A) will result in a moderate or lower risk assessment for naturally produced spring Chinook salmon within the Wenatchee, Entiat, and Methow natural populations and all threats for “high” risk have been addressed.
- Criterion 5: The score for the eight metrics of natural levels of variation (Goal B) will result in a moderate or lower risk assessment for naturally produced spring Chinook salmon within the Wenatchee, Entiat, and Methow natural populations and all threats for “high” risk have been addressed.

²⁶ For the UCR Wenatchee spring Chinook salmon population, it is a minimum 12-year geometric mean of 2,000 spawners with a minimum 1.2 spawner to spawner ratio (the minimum growth rates associated with the minimum number of spawners of a viable population) (UCSRB 2007).

²⁷ For the UCR Wenatchee spring Chinook salmon population, the use of spawning areas is measured by at least 4 of the 5 major spawning areas having either 5 percent of the total redds in the Wenatchee River Basin or 20 redds within each major spawning area, whichever is greater (UCSRB 2007).

Table 7. UCR spring-run Chinook salmon criterion 1 and 2 recovery criteria (UCSRB 2007).

Population	Minimum 12-year geometric mean for spawners	Minimum 12-year geometric mean spawner to spawner ratio
Wenatchee	2,000	1.2
Entiat	500	1.4
Methow	2,000	1.2
Total for ESU	4,500	>1.0

Table 8. Actions called for in the UCR recovery plan (UCSRB 2007) for the LNFH spring Chinook salmon program.

Action	Status
Short-term actions	
Continue to release spring Chinook into Icicle Creek to provide treaty and non-treaty harvest opportunities	On-going
Reduce the amount of in-basin straying from current hatchery program; reduce or eliminate presence of out-of-basin stock (Carson spring Chinook) on spawning grounds; and employ mechanisms to manage hatchery returns on spawning grounds in balance with naturally produced fish, e.g., tribal and sport fisheries, removal at Tumwater Dam, and other methods may be used to remove hatchery fish in excess of management objectives	On-going
Provide fish passage at Dam 5 on Icicle Creek	Completed
Change to local spring Chinook stock since there is suitable spawning and rearing habitat upstream of the hatchery	Not under consideration at this time
Size hatchery programs appropriately for available habitat given survival trends	On-going
Long-term actions	
Release spring Chinook into Icicle Creek to provide for treaty and non-treaty harvest opportunities	On-going
Modify hatchery programs to minimize adverse impacts of hatchery fish on naturally produced fish while maintaining production levels identified in various agreements	On-going

For UCR steelhead, at the population scale, the ICTRT recommended specific biological criteria based on the four viability components of VSP: abundance, productivity, spatial structure, and diversity (Table 5). The population viability ratings, in order of descending risk, are highly viable, viable, maintained, and high risk (Figure 7).

These criteria are integrated to develop a total population viability rating and delisting criteria (Table 9).

The UCR Steelhead Biological Recovery Criteria (Table 9):

- Criterion 1: The 12-year geometric mean for abundance and productivity of naturally produced steelhead within the Wenatchee, Entiat, Methow, and Okanogan natural populations must reach a level that would have no more than a 5 percent extinction-risk (viability) over a 100-year period.
- Criterion 2: At a minimum, the UCR steelhead DPS will maintain at least 3,000 spawners and a spawner-to-spawner ratio greater than 1.0 distributed among the four populations²⁸.
- Criterion 3: Over a 12-year period, naturally produced steelhead will use currently occupied major spawning areas (minor spawning areas are addressed primarily under Criteria 4 and 5) throughout the DPS according to natural population-specific criteria outlined in the Recovery Plan²⁹.
- Criterion 4: The mean score for the three metrics of natural rates and levels of spatially mediated processes (Goal A) will result in a moderate or lower risk assessment for naturally produced steelhead within the Wenatchee, Entiat, Methow, and Okanogan populations and all threats for “high” risk have been addressed.
- Criterion 5: The score for the eight metrics of natural levels of variation (Goal B) will result in a moderate or lower risk assessment for naturally produced steelhead within the Wenatchee, Entiat, Methow, and Okanogan populations and all threats for “high” risk have been addressed.

Table 9. UCR steelhead criterion 1 and 2 recovery criteria (UCSRB 2007).

Population	Minimum 12-year geometric mean for spawners	Minimum 12-year geometric mean spawner to spawner ratio
Wenatchee	1,000	1.1
Entiat	500	1.2
Methow	1,000	1.1
Okanogan	500	1.2
Total for DPS	3,000	>1.0

Although the abundance of both spring-run Chinook salmon and steelhead in the UCR has increased, the populations do not yet meet the recovery criteria in the recovery plan. In addition, all populations for both species remain at high risk in their overall viability ratings.

2.2.2. Status of Critical Habitat

In this section, we examine the range-wide status of designated critical habitat affected by the proposed action by examining the condition and trends of essential physical and biological

²⁸ For the UCR Wenatchee steelhead population, the minimum 12-year geometric mean would be 1,000 spawners with a 1.1 spawner to spawner ratio (the minimum number of spawners of a viable population) (UCSRB 2007).

²⁹ For the UCR Wenatchee steelhead population, the use of spawning areas is measured by at least 4 of the 5 major spawning areas within having the greater of at least 5 percent of the total redds in the Wenatchee River Basin or 20 redds within each of four of the 5 major spawning areas (UCSRB 2007).

1 features throughout the designated areas. For UCR spring Chinook salmon and UCR steelhead,
2 critical habitat was designated in 70 FR 52630 (September 2, 2005).

3 Both species have overlapping ranges, similar life history characteristics, and designated critical
4 habitat. Except for reaches in the uppermost areas of their geographical range and the Wenatchee
5 River Basin, most areas of critical habitat for these species are co-extensive. Each species has a
6 number of watersheds identified as comprising its designated critical habitat. The status of
7 critical habitat is based primarily on a watershed-level analysis of conservation values that
8 focused on the presence of ESA-listed species and physical features that are essential to their
9 conservation (NMFS 2005a).

10 The NMFS organized information at the 5th field hydrologic unit code (HUC) watershed scale
11 because it corresponds to the spatial distribution and site fidelity scales of salmon and steelhead
12 populations (McElhany et al. 2000). The analysis for the 2005 designations of salmon and
13 steelhead species was completed by Critical Habitat Analytical Review Teams (CHARTs) that
14 focused on large geographical areas corresponding approximately to recovery domains (NMFS
15 2005b). Each watershed was ranked using a conservation value attributed to the quantity of
16 stream habitat with “primary constituent elements” (PCE)³⁰, the present condition of those PCEs,
17 the likelihood of achieving PCE potential (either naturally or through active restoration), support
18 for rare or important genetic or life history characteristics, support for abundant populations, and
19 support for spawning and rearing populations. In some cases, our understanding of these interim
20 conservation values has been further refined by the work of technical recovery teams and other
21 recovery planning efforts that have better explained the habitat attributes, ecological interactions,
22 and population characteristics important to each species.

23 NMFS reviews the status of designated critical habitat affected by the Proposed Action by
24 examining the condition and trends of PCEs throughout the designated area. These PCEs vary
25 slightly for some species, due to biological and administrative reasons, but all consist of site
26 types and site attributes associated with life history events (Table 10).

³⁰ As previously discussed, we use the term PCE to mean PBF or essential feature, as appropriate for the specific critical habitat in this biological opinion.

Table 10. PCEs of critical habitat designated for ESA-listed salmon and steelhead considered in this opinion.

Primary Constituent Elements		Species Life History Event
Site Type	Site Attribute	
Freshwater spawning	Substrate Water quality Water quantity	Adult spawning Embryo incubation Alevin growth and development
Freshwater rearing	Floodplain connectivity Forage Natural cover Water quality Water quantity	Fry emergence from gravel Fry/parr/smolt growth and development
Freshwater migration	Free of artificial obstruction Natural cover Water quality Water quantity	Adult sexual maturation Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Estuarine areas	Forage Free of artificial obstruction Natural cover Salinity Water quality Water quantity	Adult sexual maturation and “reverse smoltification” Adult upstream migration and holding Kelt (steelhead) seaward migration Fry/parr/smolt growth, development, and seaward migration
Nearshore marine areas	Forage Free of artificial obstruction Natural cover Water quantity Water quality	Adult growth and sexual maturation Adult spawning migration Nearshore juvenile rearing
Offshore marine areas	Forage Water quality	Adult growth and sexual maturation Adult spawning migration Subadult rearing

The physical or biological features of freshwater spawning and incubation sites include water flow, quality and temperature conditions and suitable substrate for spawning and incubation, as well as migratory access for adults and juveniles (Table 10). These features are essential to conservation because without them the species cannot successfully spawn and produce offspring. The physical or biological features of freshwater migration corridors associated with spawning and incubation sites include water flow, quality and temperature conditions supporting larval and adult mobility, abundant prey items supporting larval feeding after yolk sac depletion, and free passage (no obstructions) for adults and juveniles. These features are essential to conservation because they allow adult fish to swim upstream to reach spawning areas and they allow larval fish to proceed downstream and reach the ocean or to migrate upstream to access suitable rearing habitats.

Interior Columbia Recovery Domain

Habitat quality in tributary streams in the Interior Columbia Recovery Domain, including the UCR, range from excellent in wilderness and roadless areas, to poor in areas subject to heavy agricultural and urban development (NMFS 2009b; Wissmar et al. 1994). Critical habitat

throughout much of the Interior Columbia Recovery Domain has been degraded by intense agriculture, alteration of stream morphology (i.e., channel modifications and diking), riparian vegetation disturbance, wetland draining and conversion, livestock grazing, dredging, road construction and maintenance, logging, mining, and urbanization. Reduced summer stream flows, impaired water quality, and reduction of habitat complexity are common problems for critical habitat in developed areas.

Currently, state water law over-allocates water in many stream reaches designated as critical habitat in the Interior Columbia Recovery Domain, including many stream reaches in the UCR basin, with more allocated water rights than existing stream-flow conditions can support. Withdrawal of water, particularly during low-flow periods that commonly overlap with agricultural withdrawals, often increases summer stream temperatures, blocks fish migration, strands fish, and alters sediment transport (Spence et al. 1996). Reduced tributary stream flow has been identified as a major limiting factor for all listed salmon and steelhead species in this area (NMFS 2011b)

Despite these degraded habitat conditions, the HUCs that have been identified as critical habitat for these species are largely ranked as having high conservation value. Conservation value reflects several factors: (1) how important the area is for various life history stages, (2) how necessary the area is to access other vital areas of habitat, and (3) the relative importance of the populations the area supports relative to the overall viability of the ESU or DPS.

2.2.2.1. Critical Habitat for Upper Columbia River Spring Chinook Salmon

UCR spring Chinook salmon critical habitat includes river reaches proceeding upstream to Chief Joseph Dam, as well as specific stream reaches in the following subbasins: Moses Coulee, Upper Columbia/Priest Rapids, Chief Joseph, Methow, Upper Columbia/Entiat, and Wenatchee (NMFS 2005a or b, Appendix D).

The CHART assessment for this ESU addressed four subbasins containing 15 occupied watersheds, as well as the Columbia River rearing/migration corridor {NMFS, 2005 #6445; Appendix D}. The Interior Columbia Basin Technical Recovery Team did not identify separate major groupings/strata for this ESU due to the relatively small size of the area. NMFS ranked watersheds within designated critical habitat at the scale of the fifth-field HUC (i.e., HUC 5) in terms of the conservation value they provide to each listed species they support; the conservation rankings are high, medium or low. Thus, the CHART considered the conservation value of each HUC5 in the context of a single population group.

For the Wenatchee Subbasin (HUC4#17020011), all five watersheds identified were occupied by spring Chinook salmon and considered to be of high or medium conservation value to the ESU. The Upper Wenatchee River, Chiwawa River, and Nason/Tumwater watersheds received a high conservation value rating (NMFS 2005b, Appendix D). The Icicle/Chumstick and Lower Wenatchee³¹ watersheds received a medium conservation value rating (NMFS 2005a, Appendix D).

³¹ The lower Wenatchee River contains 39.9 miles of designated critical habitat PCEs for UCR spring Chinook salmon in the action area.

With the exception of the area bordered by the mainstem Wenatchee River, tributaries such as Icicle Creek in the lower Wenatchee River were excluded from the critical habitat listing (NMFS 2005a). Although some spawning occurs in the lower Icicle Creek mainstem and in the Icicle Creek historical channel, the recovery plan identified this as a minor spawning area with medium intrinsic potential for UCR spring Chinook salmon (UCSRB 2007; Figure 8).

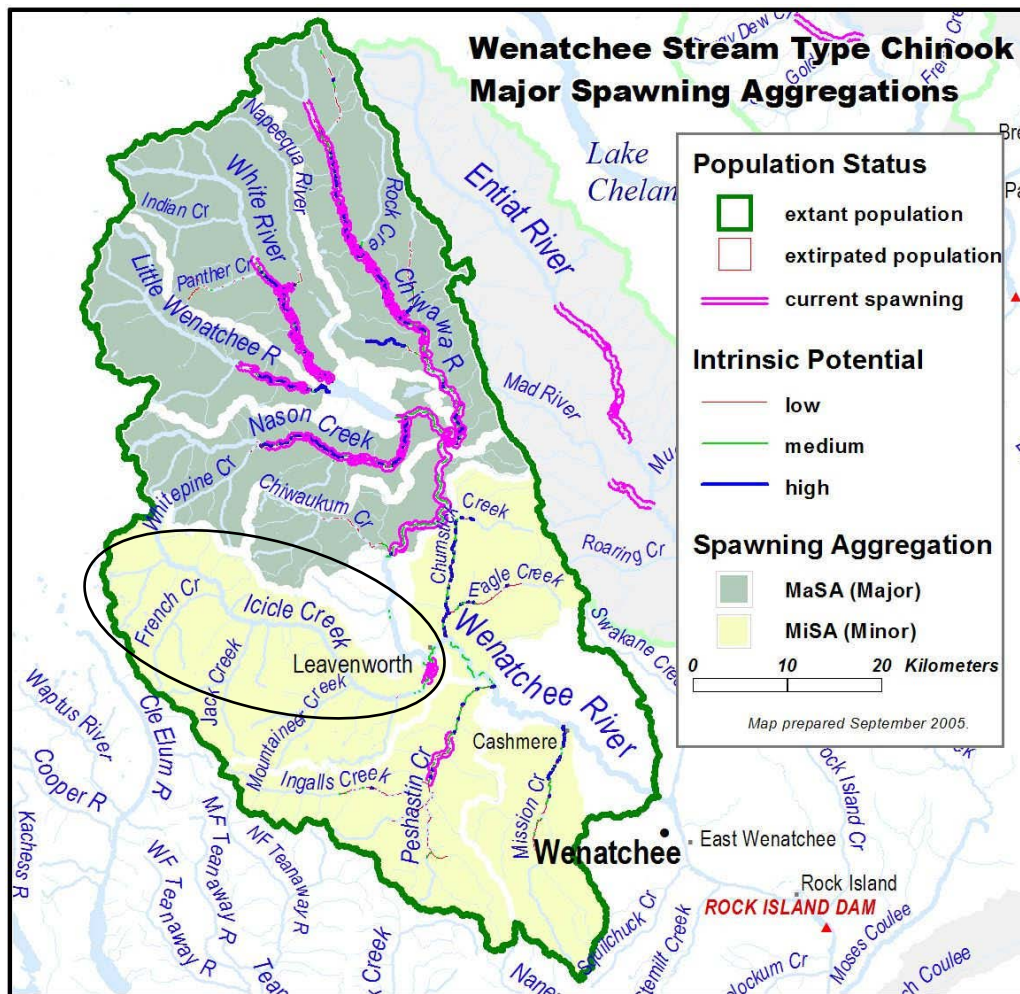


Figure 8. Distribution of major and minor spawning areas for spring Chinook salmon in the Wenatchee Basin (UCSRB 2007).

While Icicle Creek was occupied and contained PCEs³² supporting UCR spring Chinook salmon, Icicle Creek/Chumstick HUC5 (#1702001104) was excluded from being listed as part of the UCR spring Chinook salmon critical habitat because NMFS applied the “Tributaries only” exclusion and determined that the economic benefits of exclusion outweighed the benefits of designation (70 FR 52676, August 12, 2005){NMFS, 2005 #6445}. ESA-listed Wenatchee spring Chinook adult salmon (natural-origin and hatchery-origin) may be present in Icicle Creek

³² Icicle Creek contains 39.9 miles of critical habitat PCEs for UCR spring Chinook salmon, of which 5.7 miles are in the action area but were excluded from the critical habitat designation due to economic reasons (NMFS 2005a).

from May until September. CPUD and WDFW have conducted spawning surveys for spring Chinook salmon in Icicle Creek since 1989. From 1989 to 2013, the average number of spring Chinook salmon redds is 62 (range 6 – 245) (Hillman et al. 2014). In 2013, Icicle Creek contained 9.2% of all the spring Chinook salmon redds in the Wenatchee Basin (107 redds) (Hillman et al. 2014). Since 2006, an average of 18 (range 0 to 34) spring Chinook salmon redds have also been reported in Icicle Creek (Hall et al. 2014). However, the majority of natural-origin spring Chinook salmon spawning habitat of high intrinsic potential occurs in the Upper Wenatchee Basin above Tumwater Dam. The historical channel contains approximately 6% of the weighted total intrinsic potential in the Icicle Basin and 25% of the intrinsic potential total weighted area downstream of the boulder field (Bambrick 2015) where access to spring Chinook salmon spawning sites is more likely to occur. Maintaining Icicle Creek upstream passage and rearing habitat for ESA-listed adult and juvenile steelhead through the LNFH instream structures and above the primary intake would increase abundance, productivity, and spatial structure, and, thus, is important to the conservation of the Wenatchee spring Chinook salmon population and the UCR Spring Chinook Salmon ESU as a whole.

{Dominguez, 2013 #6446@ @author-year} reported that the Icicle Creek boulder field provides some indication that the area contains natural elements that contribute to impeding fish passage. The complexity of the Icicle Creek boulder field could provide for multiple fish passage routes with some areas exhibiting higher velocities and constricted flow and other areas with lower velocities {Dominguez, 2013 #6446}. All Lower, Middle, and Upper Reaches of Icicle Creek studied were found to be passable at various instream flows, with the exception of the Anchor Boulder Area in the Middle Reach that exhibited higher velocities and constricted flow that would make spring Chinook salmon passage difficult or impassable {Dominguez, 2013 #6446}.

2.2.2.2. Critical Habitat for Upper Columbia River Steelhead

UCR steelhead critical habitat includes river reaches proceeding upstream to Chief Joseph Dam, as well as specific stream reaches in the following subbasins: Columbia River/Lynch Coulee, Chief Joseph, Okanogan, Salmon, Methow, Similkameen, Chewuch, Twisp, Entiat, Wenatchee, Chiwawa, Nason, and Icicle.

The CHART assessment for this ESU addressed four subbasins containing 15 occupied watersheds, as well as the Columbia River rearing/migration corridor (NMFS 2005b; Appendix H). The Interior Columbia Basin Technical Recovery Team (ICTRT 2003; McClure et al. 2005) did not identify separate major groupings/strata for this ESU due to the relatively small size of the area. NMFS ranked watersheds within designated critical habitat at the scale of the fifth-field HUC (i.e., HUC 5) in terms of the conservation value they provide to each listed species they support; the conservation rankings are high, medium or low. Thus, the CHART considered the conservation value of each HUC5 in the context of a single population group. For the Wenatchee Subbasin (HUC4#17020011), all five watersheds identified were occupied by steelhead and considered to be of high or medium conservation value to the DPS. The Upper Wenatchee River, Chiwawa River, and Nason/Tumwater watersheds received a high conservation value rating

(NMFS 2005a, Appendix H). The Icicle/Chumstick³³ and Lower Wenatchee³⁴ received a medium conservation value rating (NMFS 2005b, Appendix H); it was unclear whether access to areas above the Icicle Creek boulder field was naturally limited. Subsequent to culvert replacements, the Chumstick Creek is experiencing a resurgence of steelhead with increased spawning (Bambrick 2015). Spawning ground survey data has demonstrated that the lower Wenatchee River, and Peshastin and Icicle Creeks, which includes Mission Creek, support a strong number of naturally spawning steelhead (Hillman et al. 2014).

Critical habitat for steelhead in Icicle Creek (e.g., Icicle/Chumstick watershed) was designated for the entire watershed; no other areas (i.e., tributaries) in Icicle Creek were excluded from the critical habitat listing (NMFS 2005a). Icicle Creek supports a major spawning aggregation for UCR steelhead (Figure 9). The lower Icicle Creek mainstem was identified as containing habitat of medium intrinsic potential for steelhead (i.e., the mouth up to the Icicle Creek historical channel). The upper mainstem and tributaries above LNFH (i.e., RM 2.8 to RM 5.7 in the action area) are identified as containing habitat with high intrinsic potential that supports PCEs necessary for the conservation of steelhead. Icicle Creek contains spawning, rearing, and migration PCEs where Icicle Creek is expected to support increased natural spawning since access to the area was recently restored and as the area restores itself following decades of limited instream flows.

The USFWS Columbia River Basin Hatchery Review Team acknowledged that ESA-listed steelhead inhabit all major tributaries of the Wenatchee River. Surveyed spawning areas in order of importance were the Wenatchee River between the Chiwawa River and Lake Wenatchee, Nason Creek, Chiwawa River, and Icicle Creek (USFWS 2007). Icicle Creek contains important habitat for ESA-listed UCR steelhead. In 2013, Icicle Creek contained 10.2% of all the steelhead redds in the Wenatchee River basin (Hillman et al. 2014). Of the 10.2% in Icicle Creek, less than 1% were located in the Icicle Creek historical channel (Hillman et al. 2014). These data support a finding that almost all of steelhead spawning in Icicle Creek occurs below RM 2.8. This is not completely surprising as during much of the period of record, habitat conditions due to operation of the LNFH Structures 2 and 5 were not conducive to steelhead passage.

³³ Icicle Creek contains 45 miles of designated critical habitat PCEs for UCR steelhead, of which 5.7 miles are in the action area.

³⁴ The lower Wenatchee River contains 55.5 miles of designated critical habitat PCEs for UCR steelhead in the action area.

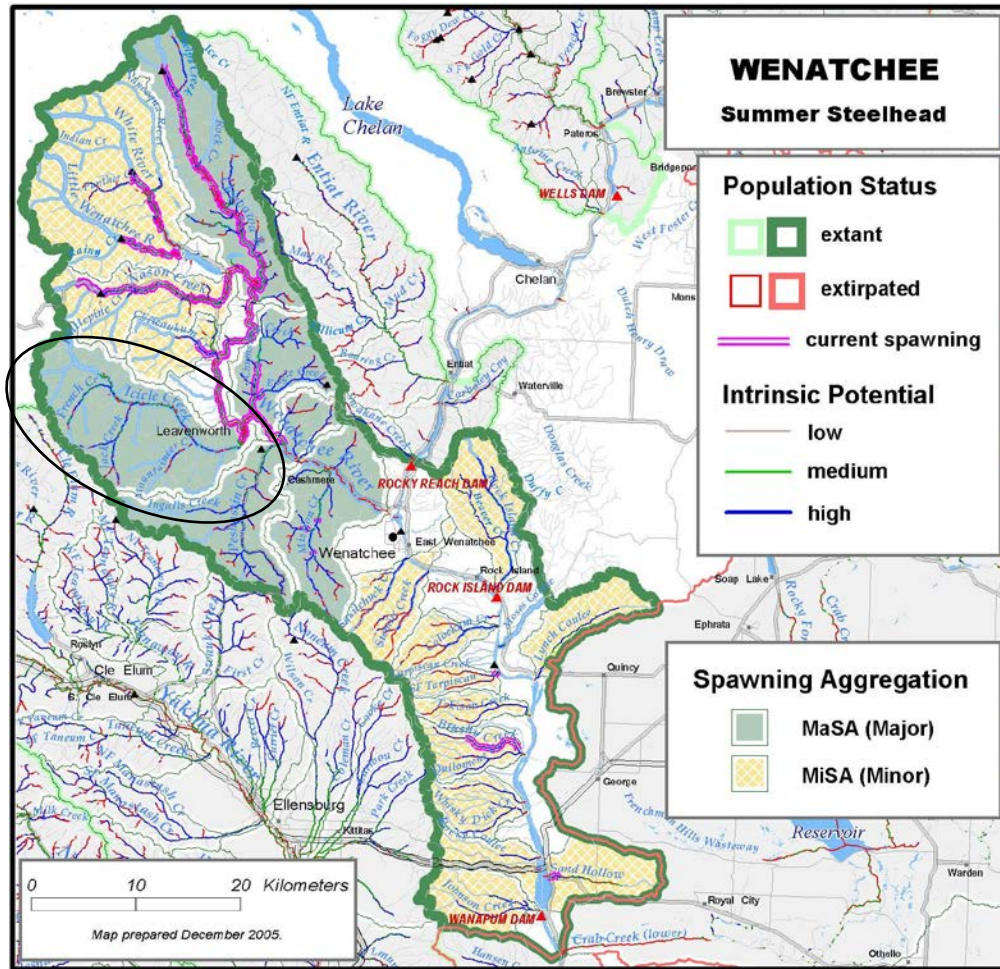


Figure 9. Distribution of major and minor spawning areas of steelhead in the Wenatchee Basin (UCSRB 2007).

The primary purpose for functional upstream fish passage for anadromous fish in Icicle Creek is to allow access to spawning and rearing habitat (Anglin et al. 2013). Spring Chinook salmon and steelhead have migrated 500 miles upstream from the ocean to arrive at the Icicle Creek drainage (Anglin et al. 2013). These salmonid species stop feeding when they enter fresh water, and their energy reserves need to be sufficient to reach the spawning grounds if successful reproduction is expected (Anglin et al. 2013). Spring Chinook salmon and steelhead swimming ability decreases as distance-traveled increases (Tillinger and Stein 1996), reducing the fitness of returning adults. Anglin et al. (2013) reported, “the deteriorating condition of anadromous fish as they move upstream from the ocean towards their spawning tributary, may be the most important reason to optimize passage conditions” in Icicle Creek. Passage and stream flow conditions are also important for rearing juvenile steelhead in Icicle Creek. This life stage generally requires shallower depths and slower velocities than adult salmonids. Steelhead juveniles are present in Icicle Creek for the entire year, thus experiencing the full range of flow conditions (Anglin et al. 2013).

{Dominguez, 2013 #6446@author-year} reported that the Icicle Creek boulder field provides some indication that the area contains natural elements that contribute to impeding fish passage. The complexity of the Icicle Creek boulder field could provide for multiple fish passage routes with some areas exhibiting higher velocities and constricted flow and other areas with lower velocities {Dominguez, 2013 #6446}. All Lower, Middle, and Upper Reaches of Icicle Creek studied were found to be passable at various instream flows, with the exception of the Anchor Boulder Area in the Middle Reach that exhibited higher velocities and constricted flow that would make steelhead passage difficult or impassable {Dominguez, 2013 #6446}. It is not known presently if steelhead are able to ascend the boulder field at RM 5.6, but recent genetic analysis of *O. mykiss* in Icicle Creek {Winans, 2014 #3397} suggests a connection between the resident rainbow trout and steelhead populations; fish above the boulder field and the Wenatchee River steelhead population shared a few similar genetic alleles. The observed relationship could be a result of, but not limited to, the following: (1) the two populations shared a common ancestry prior to isolation; (2) the resident population may be generating anadromous adults at some level that interbreed with steelhead; or (3) resident adults may be moving downstream and interbreeding with steelhead. The Upper Columbia Regional Technical Team (RTT) has designated boulder field passage assessment and fish passage improvement in Icicle Creek as priorities (RTT 2013).

2.2.3. Climate Change

Climate change has negative implications for designated critical habitats in the Pacific Northwest (ISAB 2007; Scheuerell and Williams 2005; Zabel et al. 2006). Average annual Northwest air temperatures have increased by approximately 1°C since 1900, or about 50 percent more than the global average over the same period (ISAB 2007). The latest climate models project a warming of 0.1 °C to 0.6 °C per decade over the next century. According to the Independent Scientific Advisory Board (ISAB), these effects pose the following impacts over the next 40 years:

- Warmer air temperatures will result in diminished snowpacks and a shift to more winter/spring rain and runoff, rather than snow that is stored until the spring/summer melt season.
- With a smaller snowpack, these watersheds will see their runoff diminished earlier in the season, resulting in lower streamflows in the June through September period. River flows in general and peak river flows are likely to increase during the winter due to more precipitation falling as rain rather than snow.
- Water temperatures are expected to rise, especially during the summer months when lower streamflows co-occur with warmer air temperatures.

These changes will not be spatially homogeneous across the entire Pacific Northwest. Climate and hydrology models project substantial reductions in both total snow pack and low-elevation snow pack in the Pacific Northwest over the next 50 years (Mote and Salathé 2009), changes that will shrink the extent of the snowmelt-dominated habitat available to salmon. As climate change alters the structure and distribution of rainfall, snowpack, and glaciations, each factor will in turn alter riverine hydrographs. Given the increasing certainty that climate change is occurring and is accelerating (Battin et al. 2007), NMFS anticipates salmonid habitats will be affected. Climate change may have long-term effects that include, but are not limited to, depletion of cold water habitat, variation in quality and quantity of tributary rearing habitat, alterations to migration

patterns, accelerated embryo development, premature emergence of fry, and increased competition among species (ISAB 2007).

Specific to the Columbia River Basin, the Integrated Scientific Advisory Board (ISAB) identified a number of effects climate change would have on Columbia Basin salmon, and Iceicle Creek and its tributaries, including Snow Creek, are likely to exhibit similar climate change effects. A few of these include:

(1) Water temperature increases, and depletion of cold water habitat that could reduce the amount of suitable salmon habitat by about 22% by 2090 in Washington State;

(2) Variations in precipitation that may alter the seasonal hydrograph and modify shallow mainstem rearing habitat; and

(3) Earlier snowmelt and higher spring flows with warmer temperatures that may cause spring Chinook and steelhead yearlings to smolt and emigrate to the ocean earlier in the spring (ISAB 2007).

To mitigate for the effects of climate change on listed salmonids, the ISAB (2007) recommends planning now for future climate conditions by implementing protective tributary, mainstem, and estuarine habitat measures, as well as protective hydropower mitigation measures. In particular, the ISAB (2007) suggests increased summer flow augmentation from cool/cold storage reservoirs to reduce water temperatures or to create cool water refugia in mainstem reservoirs and the estuary. The ISAB (2007) also calls for the protection and restoration of riparian buffers, wetlands, and floodplains. Although there were no specific recommendations for hatchery programs, the ISAB recommends managing to accommodate uncertainty (ISAB 2007). Hatchery programs could help with this uncertainty by serving as reserves for ESA-listed species. These will be most effective if hatchery programs make an effort to propagate populations with large phenotypic and genetic diversity to provide the greatest potential for adaptation.

Climate change is expected to further affect salmon through increases in stream temperatures and altered stream flows. In Wade et al. (2013), a spatial method for assessing salmon vulnerability to projected climatic changes (i.e., scenario for the years 2030–2059) was applied to steelhead across the entire Pacific Northwest (PNW). Steelhead exposure to increased temperatures and more extreme high and low flows during four of their primary freshwater life stages—adult migration, spawning, incubation and rearing—were examined. Steelhead sensitivity to climate change was estimated based on their regulatory status and the condition of their habitat. The study also assessed combinations of exposure and sensitivity to suggest actions that may be most effective for reducing steelhead vulnerability to climate change. Results of the study indicated historical weekly mean water temperatures approached lethal limits, and estimated exposure to higher temperatures for adult steelhead would be greatest in the UCR Basin (Wade et al. 2013). During steelhead migration, shifts in frequency and timing of high temperatures and increases in the duration and intensity of high flows were also predicted to be greatest in the UCR Basin as compared to other areas of the PNW (Wade et al. 2013). During steelhead rearing, exposure (e.g., lack of cover due to low stream flows) was more prevalent as well (Wade et al. 2013).

Thus, climate change may result in changes to flows and temperatures within the UCR Basin that could exacerbate the effects of other anthropogenic (i.e., human made) habitat alterations. Habitat actions can address some of the adverse impacts of climate change on salmon. Examples include restoring connections to historical floodplains, and restoring freshwater and estuarine habitats to provide fish refugia and areas to store excess floodwaters; protecting and restoring riparian vegetation to ameliorate stream temperature increases; and purchasing or applying easements to lands that provide important cold water or refuge habitat (Battin et al. 2007; ISAB 2007).

2.3. Environmental Baseline

In the Environmental Baseline section, NMFS describes what is affecting ESA-listed species and designated critical habitat in the action area before including any effects resulting from the Proposed Action. The “environmental baseline” includes the past and present impacts of all Federal, state, or private actions and other human activities in the action area, the anticipated impacts of all proposed federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of state or private actions that are contemporaneous with the consultation in process (50 CFR 402.02). The effects of future actions over which the Federal agency has discretionary involvement or control will be analyzed as “effects of the action.”

Wide varieties of human activities have affected UCR spring Chinook salmon, steelhead, and PCEs in the action area. These activities, more recently, include reclamation actions that are having beneficial effects.

In order to understand what is affecting a species, it is first necessary to understand the biological requirements of the species. Each stage in a species’ life history has its own biological requirements (Groot and Margolis 1991; NRC 1996; Spence et al. 1996). Generally speaking, anadromous fish require clean water with cool temperatures and access to thermal refugia, dissolved oxygen near 100 percent saturation, low turbidity, adequate flows and depths to allow passage over barriers to reach spawning sites, and sufficient holding and resting sites. Anadromous fish select spawning areas based on species-specific requirements of flow, water quality, substrate size, and groundwater upwelling. Embryo survival and fry emergence depend on substrate conditions (e.g., gravel size, porosity, permeability, and oxygen concentrations), substrate stability during high flows, and, for most species, water temperatures of 13°C (55.4°F) or less. Habitat requirements for juvenile rearing include seasonally suitable microhabitats for holding, feeding, and resting. Migration of juveniles to rearing areas, whether the ocean, lakes, or other stream reaches, requires free access to these habitats.

Information relevant to the environmental baseline is also discussed in detail in Chapter 5 of the Supplemental Comprehensive Analysis (SCA), which in turn cross-references back to the related 2008 FCRPS biological opinion (NMFS 2008b; NMFS 2008d). Chapter 5 of the SCA (NMFS 2008d), and related portions of the FCRPS Opinion, provide an analysis of the effects of past and ongoing human and natural factors on the current status of the species, their habitats and ecosystems, within the entire Columbia River Basin. In addition, chapter 5 of the SCA, and related portions of the FCRPS Opinion, evaluate the effects of those ongoing actions on

designated critical habitat with that same area. Those portions of chapter 5 of the SCA, and environmental baseline section of the FCRPS Opinion, that deal with effects in the action area (as described in Section 1.4 above) are hereby incorporated here by reference. In addition, the environmental baseline for this opinion includes the impacts of the Proposed Action described in the FCRPS and Reclamation biological opinions (NMFS 2008b). Additional information on the historical and current condition of Icicle Creek (e.g., pre-action condition) was provided in the USFWS SBA and is also incorporated by reference (USFWS 2014). Actions and their effects of particular importance to the current proposed action are summarized below.

2.3.1. Land Ownership

The Wenatchee basin consists of five sub-watersheds (the Chiwawa, White, Little Wenatchee, and Wenatchee Rivers and Nason Creek), which drain a combined total of approximately 1,300 square miles (NPCC 2004). The Wenatchee River enters the Columbia River at RM 468 between Rocky Reach and Rock Island dams.

Icicle Creek encompasses 136,960 acres and enters the Wenatchee River at approximately RM 25. The Icicle Creek watershed contributes 20 percent of the annual average low season flows to the Wenatchee River {WSCC, 2001 #67}. Icicle Creek originates high in the Cascade Mountains and drains an area of 214 square miles (136,960 acres; USFS 1995) in North Central Washington. Icicle Creek runs 31.8 river miles before emptying into the Wenatchee River at the City of Leavenworth.

Land uses in the Wenatchee basin consist of commercial forest (86 percent areal coverage), commercial agriculture (1 percent), rural (12 percent), urban (0.5 percent), and open water (0.3 percent). Approximately 76 percent of the lands in the basin are managed by the U.S. Forest Service {USFS, 1994 #3435}. Approximately 18.5 percent of the basin is privately owned and almost two-thirds contain lower-gradient streams that support anadromous fish such as salmon and steelhead {USFS, 1994 #3435}. Agriculture consists primarily of orchards (93 percent) with some production of hay, grains, and row crops (6.5 percent) (NPCC 2004).

2.3.2. Resource Development

Wide varieties of human activities have affected UCR spring Chinook salmon and UCR steelhead, and their important habitat PCEs in the action area. Although land and water management activities have improved, factors such as hydroelectric and hatchery diversions and dams, agricultural activities, stream channelization and diking, roads and railways, historical forest management and timber harvest, and urban development still affect UCR spring Chinook salmon and steelhead and their designated habitat (UCSRB 2007).

Many stream reaches in the UCR have more allocated water rights than existing stream flow conditions can support. Reduced tributary stream flow has been identified as a major limiting factor for all listed UCR salmon and steelhead (NMFS 2007c; 2011b). Critical habitat is designated in the upper and lower mainstem Wenatchee River and upper tributaries (above Tumwater Dam) only for ESA-listed spring Chinook salmon, not including Icicle Creek. Critical habitat is designated in the mainstem Wenatchee River and tributaries in the sub-basin, including Icicle Creek, for ESA-listed steelhead (Section 2.2.1.1 and Section 2.2.1.2). Migration routes for

1 UCR spring Chinook salmon and steelhead are still disrupted by water diversions without proper
2 adult and juvenile passage routes, unscreened diversions that trap or divert adults and juveniles,
3 instream structures that impede adult and juvenile passage, hydroelectric passage mortality that
4 reduces abundance of migrants, and sedimentation from land and water management that causes
5 loss of habitat complexity, off-channel habitat, and deep pools and/or loss of pool-forming
6 structures such as boulders and large woody debris (UCSRB 2007).

7
8 Habitat quality in the lower Icicle Creek (within the action area) is considered impaired by
9 forestry practices, private land development in floodplain and riparian areas, roads, and
10 agriculture. The U.S. Forest Service (USFS) reports that about 4.5% of the drainage has been
11 harvested {USFS, 1994 #3435}. Private land development occurs in the lower reach of the
12 watershed within the floodplain and riparian areas. This is primarily single-family residences and
13 roads (USFS 1995). There have been numerous land use/land management related habitat
14 impacts in the channel migration zone of lower Icicle Creek (NMFS 2002). Based upon analysis
15 of aerial photographs, Chapman et al. (1994) found that 11.2% of Icicle Creek between RM 0.2
16 and 1.8 had no riparian vegetation. Portions of Icicle Creek Road and some USFS campgrounds
17 affect the floodplain (NMFS 2002). Additionally, a substantial quantity of stream bank along
18 Icicle Creek Road has been altered with riprap (NMFS 2002).

19
20 Water use is a high demand resource in the watershed, with multiple small irrigators, two
21 irrigation districts, and the LNFH all drawing water from the watershed (NMFS 2002). Low flow
22 conditions and associated high instream temperatures in the lower reaches of Icicle Creek from
23 RM 5.7 at the IPIDs water diversion downstream to the mouth negatively affect salmonid fish
24 passage and decrease habitat quantity. Reduced stream flow and increased water temperatures in
25 the lower 3.8 miles of Icicle Creek may affect ESA-listed spring Chinook salmon and steelhead
26 and reduces habitat in the Icicle Creek watershed in the Wenatchee Basin.

27
28 The following sections describe conditions in Icicle Creek relevant to the proposed action from
29 1937 (development of the LNFH) to the present.

30
31 a) 1937 to 2003

32
33 Development of the LNFH began in 1937 when three river miles of Icicle Creek below the
34 boulder falls were fenced off for experimental salmon production (USFWS 2014). Salmon were
35 captured at Rock Island Dam and held in the fenced area of Icicle Creek through the spawning
36 period {Brennan, 1938 #3437}. Upstream fish passage was blocked during the spawning season,
37 and blockage was likely extended until construction of the LNFH began in 1938 (USFWS 2014).
38 From 1938 through 2000, upstream fish passage was blocked year round at approximately RM
39 2.8 due to instream structure 5 (USFWS 2014). In 1942, the LNFH obtained water rights to
40 Icicle Creek surface water and Snow and Nada Lakes and began exercising those rights soon
41 thereafter (USFWS 2014). The LNFH diversion dam at RM 4.5 prevented fish access upstream
42 to 24.5 miles of mainstem Icicle Creek habitat (Mullan et al. 1992a){USFS, 1994 #3435}. The
43 hatchery's intake at RM 4.5 blocked fish passage at low flows {USFWS, 2001 #3436}. During
44 several months of the year, fish passage in Icicle Creek was blocked by structures in the
45 mainstem (i.e., Structure 1 and Structure 5) and in the Icicle Creek historical channel (i.e.,
46 Structure 2) with little to no flow in the Icicle Creek historical channel (NMFS 2002). Two of the

1 LNFH structures (i.e., Structures 3 and 4) effectively blocked fish passage (at RM 2.8) to the
2 upper Icicle and were no longer needed for hatchery operations (NMFS 2002).

3
4 Spring Chinook salmon spawning ground surveys were conducted by WDFW in Icicle Creek
5 since 1989 (Hillman et al. 2014). From 1989 to 2003, an average of 47 (range 6 to 245) spring
6 Chinook salmon redds were encountered in Icicle Creek (Hillman et al. 2014). The origin of
7 Icicle Creek spring Chinook salmon was unknown. {NMFS, 1999 #3424@ author-year}
8 reported that spring Chinook spawning in Icicle, Peshastin, and Ingalls Creeks were likely from
9 hatchery-derived populations.

10
11 Evidence suggests that historically Icicle Creek produced native steelhead (Mullan et al.
12 1992b){Brennan, 1938 #3437;Fulton, 1970 #3438}. In 1997, NMFS completed a status review
13 of West Coast steelhead that resulted in NMFS listing UCR steelhead as endangered (Busby et
14 al. 1996; 62 FR 43937, August 18, 1997). The status of UCR steelhead in the lower Icicle Creek
15 was unknown at this time but it is unlikely that migrating steelhead passed RM 2.8. It is also
16 likely steelhead were subject to competition and genetic introgression from interactions with
17 hatchery steelhead and rainbow trout and habitat effects related to low flow conditions in Icicle
18 Creek (USFWS 2014).

19
20 In the Icicle Creek watershed, natural conditions³⁵ may also limit fish access to tributaries.
21 However, the remaining upstream habitat has significant production potential {WSCC, 2001
22 #67}. The Icicle Creek watershed contributes to additional spawning and migration habitat to
23 ESA-listed spring Chinook salmon and steelhead in the Wenatchee basin {WSCC, 2001 #67}.
24 With improvements in the watershed, Icicle Creek could contribute to the increased spatial
25 structure, abundance, and productivity of the Wenatchee spring Chinook salmon and steelhead
26 populations. Although, none of the water diversions have been proven to be year round barriers
27 {USFWS, 2001 #3436}, they limit passage of ESA-listed species for all life stages (i.e.,
28 spawning, migration, and rearing).

29
30 b) 2004 to 2010

31
32 In the winter of 2006, the LNFH began to document operations of instream structures 2 and 5
33 (USFWS 2014). The original design of the LNFH involved diverting 42 cfs out of the creek and
34 into a hatchery channel with an energy control dam at the base and construction of holding dams
35 and weirs in the Icicle Creek mainstem and historical channel (USFWS 2014). In 2007, the
36 USFWS Columbia River Basin Hatchery Review Team stated, “Upstream fish passage is a
37 significant issue in Icicle Creek. At the present time, hatchery structures impeded upstream fish
38 passage at three locations: (1) Structure 5 immediately upstream of the hatchery fish ladder and
39 bypass canal spillway (RM 2.8); (2) Structure 2 and associated headgate for diverting Icicle
40 Creek water into the bypass canal (i.e., Hatchery Channel); and (3) a low-head dam (i.e.,
41 Structure 1) for diverting Icicle Creek water into the intake pipe for the hatchery (RM 4.5)”
42 (USFWS 2007). The USFWS also stated that, “NOAA Fisheries, the USFWS Ecological
43 Services office in Wenatchee, and the Wild Fish Conservancy (formerly Washington Trout) are
44 very concerned about passage issues for ESA-listed bull trout and summer steelhead at the
45 lower-most structure in Icicle Creek (Structure 5) and at the water intake structure” (Structure 1)

³⁵ Natural conditions include steep gradients, waterfalls, and stream flow.

(USFWS 2007). In 2007, the USFWS Columbia River Basin Hatchery Review Team identified recommendations for the LNFH. The review team stated that the LNFH posed a demographic risk to ESA-listed steelhead because the water intake screening did not comply with NOAA Fisheries fish exclusion guidelines (USFWS 2007). In addition, passage facilities for upstream migrating fish around the hatchery instream structures were “inadequate” and instream flows in Icicle Creek did not meet minimum requirements between the hatchery intake (RM 4.5) and the hatchery outflow (RM 2.4) (USFWS 2007). The USFWS Columbia River Basin Hatchery Review Team report stated, “[i]n some years, this latter section of Icicle Creek has gone completely dry during the summer [in the historical channel], although the majority of water is withdrawn by irrigation companies during months of lowest flows” (USFWS 2007).

WDFW spring Chinook salmon spawning grounds surveys continued. From 2004 to 2010, an average of 58 (range 8 to 155) spring Chinook salmon redds were encountered in Icicle Creek (Hillman et al. 2014).

Steelhead spawning ground surveys³⁶ have been conducted since 2004 in Icicle Creek (Hillman et al. 2014). From 2004 to 2010, an average of 48 (range 8 to 120) steelhead redds were encountered (Hillman et al. 2014). In 2005, NMFS designated critical habitat for UCR steelhead (70 FR 52630, September 2, 2005). Upstream fish passage opportunities were expanded but due to the LNFH’s operation of structures 2 and 5 during spring Chinook salmon broodstock collection, adult steelhead migration was still blocked at the end of the normal run period (USFWS 2014).

In 2005, a group of regional experts³⁷ convened to assess potential steelhead spawning habitat in the Icicle Creek historical channel and the reach above the LNFH (up to RM 5.7) {Hall, 2014 #3439}. The group estimated (visually) 1,822 square meters of suitable spawning habitat³⁸ in the former reach and about 26 square meters in the latter reach. The group noted that, following the Icicle Creek Restoration Project³⁹, the Icicle Creek historical channel was in a state of transition from wetland to riverine habitat such that the condition of spawning habitat may further improve {Hall, 2014 #3439}.

c) 2011 to the Present

Beginning in 2011, the LNFH has made a number of changes to improve the quantity and complexity of habitat in the historical channel, allowing greater frequency of adult steelhead passage, and improved efficiency of ground water usage. During this time, structures 2 and 5 have remained open during much of the hatchery’s spring Chinook salmon broodstock collection period to allow for upstream fish passage and higher instream flows in the Icicle Creek historical channel, unless the limit for the number of LNFH adult spring Chinook salmon⁴⁰ has been

³⁶ Icicle Creek steelhead surveys were conducted by WDFW using consistent methodologies below RM 2.4 since 2004 and in the historical channel since 2006.

³⁷ Regional experts consisted of biologists representing NMFS, USFWS, WDFW, USFS, and the Yakama Nation.

³⁸ The group also noted that high levels of sedimentation could potentially affect spawning success.

³⁹ Removal of the LNFH instream structures 3 and 4.

⁴⁰ Starting in 2011, structures 2 and 5 remain in the open position all year except if the following conditions arise:

(1) 50 returning adult SCS pass upstream of structure 5 during broodstock collection (mid-May through June 24);

1 reached (USFWS 2014). If so, trapping procedures are in place to release natural-origin
2 migrating spring Chinook salmon and steelhead upstream or downstream of structure 5⁴¹.
3 Structure 2 continues to be operated for 15 consecutive days or less for up to 5 times each year
4 for aquifer well recharge alone.

5
6 Consistent with past operations, the LNFH continues to divert up to 42 cfs of surface flow (at
7 RM 4.5) from Icicle Creek year round and to discharge 50 cfs of surface water (at RM 5.7) from
8 Snow/Nada Lake Reservoirs into Icicle Creek during the months of August and September
9 (USFWS 2014). Up until now, IPID has not used water from Snow/Nada Lake and Snow Creek;
10 thus, there have been no additional effects on ESA-listed species in Icicle Creek. IPID has
11 recently informed the LNFH that they intend to use 10 cfs of supplemental flow for 38 days
12 during the 2015 irrigation season⁴². Thus, in the current water year, for 38 days, 10 cfs may not
13 be available resulting in only 40 cfs of supplemental stream flow to Icicle Creek. This action
14 may also occur in subsequent years.

15
16 In 2011, a minimum instream flow goal of 20 cfs was proposed for the Icicle Creek historical
17 channel, particularly during operation of Structure 2 when re-routing of water from the Icicle
18 Creek historical channel would occur to the hatchery channel to recharge aquifers. In the spring
19 of 2014, the LNFH made additional improvements to the radial gates at Structure 2. In
20 November 2014, the USFWS again proposed a minimum instream flow goal of 20 cfs in the
21 Icicle Creek historical channel (USFWS 2014).

22
23 The minimum collective instream flow goal under the current proposed action is for 100 cfs to
24 provide enough stream flow for various stages of salmonid life history. The monthly average
25 instream flow for Icicle Creek in 2016 is summarized below. [placeholder for info from FWS]

26
27 WDFW spring Chinook salmon spawning surveys continue. From 2011 to 2013, an average of
28 143 redds (range 107 to 199) were encountered in Icicle Creek (Hillman et al. 2014). Similarly,
29 the redd counts were 211 in 2014 and 132 in 2015 [CPUD report]. Icicle Creek is a minor
30 spawning area for UCR spring Chinook salmon (Section 2.2.2.1) and most likely influenced by
31 LNFH origin spring Chinook that spawn in Icicle Creek {NMFS, 1999 #3424}.

32
33 WDFW steelhead spawning surveys also continue. From 2011 to 2013, an average of 92 redds
34 (range 47 to 180) were encountered in Icicle Creek (Hillman et al. 2014). Redd surveys were not
35 performed for steelhead in 2014 and 2015 [CPUD report]. Icicle Creek is a major spawning area
36 for UCR steelhead (Section 2.2.2.2). No hatchery releases of steelhead in Icicle Creek have
37 occurred since 1997. The last return of LNFH-produced steelhead to Icicle Creek occurred in
38 2000 {Hall, 2014 #3439}.

(2) stream flow through the hatchery channel is not sufficient to promote smolt emigration during release in mid-April; (3) stream flow in the hatchery channel has not been sufficient enough to recharge the shallow aquifer; (4) high stream flows from spring runoff and rain-on-snow events are endangering downstream infrastructure; or (5) during maintenance of structure 5.

⁴¹ Steelhead are released upstream or downstream depending on spawning status.

⁴² Irrigation season is from May – October.

2.3.3. Restoration

The USFWS completed the Icicle Creek Restoration Project in 2002. The goal of the project was to improve the migration of ESA-listed and non-ESA-listed species through Icicle Creek because of the LNFH in-river structures that entrained fish and blocked passage. Phase I involved removal of Structures 3 and 4 and was completed in 2003, which included removal of any diffusion dams, racks, abutments, flumes, and concrete foundations. The project also included flushing sediments and restoring streamflow to the historical Icicle Creek channel to improve passage conditions for listed salmonids, particularly steelhead and bull trout. Any native spring Chinook salmon attempting to migrate through the hatchery grounds was also provided access in order to migrate upstream of the hatchery. In-channel structures were installed to reduce bank erosion and provide cover and pool habitat for rearing salmonids. The purpose of Phase II was to restore long-term, year-round sustainable passage and riverine fish habitat through LNFH instream structures by reconditioning all parts of Structure 2. A vertical slot fishway would be constructed at the headgate to provide fish passage. The fishway would be designed to allow passage of all life stages of salmonids (NMFS 2002).

Phase II has not been implemented. As mentioned above, the upstream habitat in Icicle Creek has important production potential, particularly for ESA-listed steelhead. Icicle Creek has consistently had steelhead redds in the lower 2 miles and spawning surveys are limited to downstream areas. Designated critical habitat for ESA-listed steelhead has a medium conservation value (see Section 2.2.2.2) with the majority of spawning limited to the lower Icicle Creek mainstem (with even less spawning currently occurring in the Icicle Creek historical channel). In NMFS' recovery planning analysis for evaluating potential habitat condition improvements for salmon and steelhead in the Columbia River Basin {NWFSC, 2004 #3440}, the Icicle Creek watershed was considered a major spawning area containing habitat with medium intrinsic potential habitat that supports important physical or biological features that are essential to the conservation of the species, for steelhead in the lower mainstem (mouth up to historical channel) (NWFSC 2004). Habitat with high intrinsic potential was identified as being located above the LNFH {NWFSC, 2004 #3440} (Section 2.2.2.2) but is likely limited by natural passage impediments present at most flows.

Due to implementation of Phase I of the Icicle Creek Restoration Project, habitat in the Icicle Creek historical channel has improved. From 2010 to 2013, an average of 95 (range 43 to 175) steelhead redds were documented in Icicle Creek below RM 2.8 and an average of 3.8 (range 2 to 5) steelhead redds were documented in the Icicle Creek historical channel {Hall, 2014 #3439}. Icicle Creek also contains important rearing and migration PCEs in habitat above the LNFH to RM 5.7 (NMFS 2005b). The Icicle Creek historical channel is the only corridor that provides access to this upstream habitat. Currently, spawning data show that the majority of steelhead are confined to the lower Icicle Creek (from RM 2.8 to RM 0.0), which contains degraded habitat due to the land use activities described above.

The Pacific Coastal Salmon Recovery Fund (PCSRF) was established by Congress to help protect and recover salmon and steelhead populations and their habitats (NMFS 2007b). The states of Washington, Oregon, California, Idaho, and Alaska, and the Pacific Coastal and Columbia River tribes, receive PCSRF appropriations from NMFS each year. The fund supplements existing state, tribal and local programs to foster development of Federal-state-

tribal-local partnerships in salmon and steelhead recovery. The PCSRF has made substantial progress in achieving program goals, as indicated in annual Reports to Congress, workshops, and independent reviews.

The UCR recovery plan for UCR spring Chinook salmon and steelhead (UCSRB 2007) describes recovery actions intended to reduce threats associated with land and water management. The following short-term and long-term actions are intended to reduce the primary threats to improve aquatic and riparian conditions where feasible and practical:

Short-term Protection Actions

Use administrative and institutional rules and regulations to protect and restore stream and riparian habitats on public lands within the following assessment units:

- Middle Wenatchee
- Upper Wenatchee
- Upper Icicle Creek
- Chiwaukum
- Chiwawa River
- Lake Wenatchee
- Little Wenatchee
- White River

Short-term Restoration Actions

Implement the following actions throughout the entire Wenatchee Basin:

- Address passage barriers
- Address diversion screens
- Reduce the abundance and distribution of brook trout through feasible means (e.g., increased harvest).

Lower Icicle Creek Assessment Unit (Category 2; Appendix G.1):

- Increase connectivity by improving fish passage over Dam 5 (i.e., Structure 5) in the lower Icicle Creek
- Reduce sediment recruitment by restoring riparian vegetation between the mouth of the Icicle and the boulder field (RM 0.0 - 5.4)
- Improve road maintenance to reduce fine sediment recruitment in the upper watershed
- Increase habitat diversity and quantity by restoring riparian vegetation, reconnecting side channels, and reconnecting the floodplain with the channel in lower Icicle Creek
- Use practical and feasible means to increase stream flows (within the natural hydrologic regime and existing water rights) in Icicle Creek

Long-term Actions

- Protect and maintain stream and riparian habitats within Category 1 assessment units
- Protect, maintain, or enhance beneficial stream and riparian habitat conditions established by implementing Short-term Actions within assessment units

- Where feasible and practical, maintain connectivity throughout the historical distribution of the species

NMFS has completed ESA consultation on the activities of the NOAA Restoration Center in the Pacific Northwest (NMFS 2004b). These include participation in the Damage Assessment and Restoration Program, Community-based Restoration Program (CRP), and the Restoration Research Program. The CRP is a financial and technical assistance program, which helps communities to implement habitat restoration projects. Projects are selected for funding based on their ecological benefits, technical merit, level of community involvement, and cost-effectiveness. National and regional partners and local organizations contribute matching funds, technical assistance, land, volunteer support or other in-kind services to help citizens carry out restoration.

In 2012, the Icicle Creek Work Group (IWG) was formed to develop a comprehensive water resources management strategy for the Icicle Creek Watershed. The group's broad membership includes two Native American tribes, environmental groups, county and city government, irrigation districts, recreational interests, and State and Federal agencies, including the LNFH. The group adopted nine guiding principles, including operating LNFH in a sustainable manner and improving stream flow to support healthy habitat. The group also formed an instream flow subcommittee that recommended minimum flows in the Icicle Creek historical channel of 100 cubic feet per second (cfs), except in drought years, when they recommend a minimum flow of 60 cfs. The IWG also recommended a goal of 250 cfs in the Icicle Creek historical channel during wet water years.

In summary, human activities have impaired habitat quality in the Icicle Creek watershed, including low flow conditions and associated high instream temperatures due to water withdrawals and man-made passage barriers in the lower reaches of Icicle Creek that reduce salmonid fish passage, connectivity between Icicle Creek and the rest of the Wenatchee Basin, and habitat quality and quantity. Some improvements in fish passage and instream flows in lower Icicle Creek, including the historical channel, have occurred. Nevertheless, fish passage in the Icicle Creek historical channel are limited by reduced flows and by the physical characteristics of the LNFH instream structures, and such passage limitation prevent access to habitat with high intrinsic potential upstream of the hatchery. The instream structures also reduce water quality and quantity of UCR steelhead designated critical habitat in the Icicle Creek historical channel and downstream areas. Improvements to address some of these impediments are part of the proposed action.

2.3.4. Hatchery Propagation

Early attempts to establish hatcheries on the Columbia River above the confluence of the Yakima River were generally unsuccessful. Beginning in 1899, with the construction of a fish hatchery on the Wenatchee River by the Washington Department of Fish and Game, hatcheries were constructed and subsequently abandoned on the Colville, Little Spokane, and Methow Rivers. Hatchery records indicate that relatively few Chinook salmon were spawned (Craig and Suomela 1941). Attempts to improve the spring Chinook salmon run with imported eggs (most notably from the upper Willamette River) were also unsuccessful (Craig and Suomela 1941).

The spring Chinook salmon hatchery program most relevant to the proposed action is the Leavenworth National Fish Hatchery (LNFH) spring Chinook salmon program. Spring Chinook salmon from all over the Columbia Basin have been relocated here to provide hatchery broodstock; this has resulted in a heightened threat or risk to the diversity of spring Chinook salmon in the ESU, and particularly in the Upper Wenatchee and Entiat Basins. The LNFH began releasing juvenile spring Chinook salmon in 1941. For the first two decades, there was an attempt to focus on local-origin broodstock. From 1941-1944, broodstock was primarily from fish collected at Rock Island Dam as part of the Grand Coulee Fish-Maintenance Project. In 1942, approximately 200,000 fish from the McKenzie River (a Willamette River tributary) were also released. Between 1944 and 1971, releases only occurred sporadically. In 1948, approximately 800,000 sub-yearling progeny of fish returning to Icicle Creek were released. In 1967 and 1968, approximately 300,000 yearlings of Clackamas River-origin (Eagle Creek NFH) were released. From 1971 to 1993, production consisted of large-scale releases (1 million or more yearlings annually) of spring Chinook salmon transferred primarily from Carson and Wind River NFHs (Carson derivative), combined with returns from Icicle Creek. Mixed-origin Carson stock was developed beginning in 1958 of predominantly Snake River Basin spring Chinook salmon intercepted at Bonneville Dam. Since 1994, the broodstock has been composed entirely of returns to Icicle Creek (Mullan et al. 1992a; NRC 1996; Utter et al. 1995).

Returning LNFH adults (brood years 1999 – 2009), during which the production was 1.625 million smolts, are marked at a 100% adipose fin-clip rate (beginning brood year 2000), and an average coded-wire-tag (CWT) rate of 33% (range 11% – 59%) (Hall 2014). The current production level is 1.2 million spring Chinook salmon smolts annually. Straying of LNFH-origin hatchery spring Chinook salmon into the natural spawning areas for Wenatchee spring Chinook salmon has been a concern. In 2007, the USFWS Columbia River Basin Hatchery Review Team made a recommendation to “move promptly to unique marks or tags for LNFH and Upper Wenatchee River hatchery programs” and to “establish a system for differentially marking or tagging LNFH spring Chinook and Chiwawa River hatchery spring Chinook” (USFWS 2007). Prior to 2011, the proportion of LNFH origin spring Chinook salmon spawning naturally in areas upstream of Tumwater Canyon contributed to a high risk rating for diversity. From 2001 to 2003, 34.6% of all naturally spawning spring Chinook salmon in the Upper Wenatchee River, upstream of Tumwater Dam, were composed of adults from the LNFH based on estimates derived from expanded coded-wire-tag (CWT) recoveries (USFWS 2007). In 2007, LNFH adult spring Chinook salmon composed a combined average of 9% of the natural spawners (i.e., carcass recoveries) in the Chiwawa River, Chickamin Creek, and Rock Creek, 53% of the natural spawners in the Little Wenatchee River, 18% of the natural spawners in Nason Creek, 3% of the natural spawners in the Little Wenatchee River, Napeequa Creek, and Panther Creek, and 89% of the natural spawners in the Upper Wenatchee mainstem (USFWS 2007). By the early 2000s, only 2.6% of LNFH spring Chinook salmon strayed outside of Icicle Creek, but they represented a relatively high proportion of the natural spawners in some areas upstream of Tumwater Dam because of the very low abundance of natural origin spring Chinook salmon adults in the Wenatchee Basin (USFWS 2007). To address this concern, LNFH reduced the coded-wire-tag (CWT) rate on hatchery spring Chinook salmon to 18% with 100% of the fish adipose fin-clipped to continue to provide a differential mark for removal of LNFH-origin fish at Tumwater Dam (NMFS 2011a). This reduction in LNFH CWT rate and 100% adipose fin clip corresponded with an increase in CWT rate and the presence of an adipose fin for the Nason

Creek spring Chinook salmon hatchery supplementation program. Prior to 2013, the Nason Creek mitigation obligation was fulfilled through the Chiwawa River safety net program, which had a mark identical to the LNFH program fish. Beginning in 2013, the GPUD was able to fulfill their mitigation obligation through a Nason Creek spring Chinook salmon conservation component of the Wenatchee River hatchery supplementation program so that the number of CWT fish with an adipose fin increased, thus allowing for better identification and removal of LNFH fish at Tumwater Dam. Since 2009, 82% of potential LNFH-origin stray hatchery fish are identifiable for removal during standard adult management and broodstock collection efforts at Tumwater Dam while working collaboratively with CPUD and WDFW (NMFS 2011a). From 2004-2012, the mean LNFH-origin component of the Upper Wenatchee River spring Chinook salmon escapement was 0.8% (range 0% to 3.2%) {Hall, 2014 #36}. Increased marking efforts have facilitated greater removal of these fish before they can spawn naturally. Currently, the LNFH program has a pHOS of less than 1% in the Wenatchee Basin {Hall, 2014 #36} and approximately 2% in the Entiat Basin (Cooper 2012) (Section 2.4.2.2).

From 2008 to 2011, natural-origin adult spring Chinook salmon encounters at LNFH remained roughly the same at one wild adult per year. However, broodstock collection in recent years has shown an increase in the handling of ESA-listed hatchery-origin spring Chinook salmon (Gale 2012a; Gale 2012b), averaging 88 fish annually. These strays were predominantly from the Chiwawa Spring Chinook Salmon Hatchery Program (Gale 2012a). A proportion of spring Chinook salmon are also adipose-fin-clipped from the Wenatchee spring Chinook salmon hatchery programs⁴³ safety-net component. Since it is difficult to positively identify one ad-clipped adult spring Chinook salmon in the Wenatchee Basin from another (i.e., those without a CWT or other identifying tag or mark), these fish are sometimes incidentally incorporated into the LNFH broodstock. From 2011 to 2014, up to 1 natural-origin and 31 (range 3 to 86) hatchery-origin spring Chinook salmon volunteered into the LNFH ladder during annual broodstock collection.

In addition to the LNFH spring Chinook salmon hatchery program, there are seven other hatchery programs in the action area. The CPUD, GPUD, WDFW, YN, and BPA fund and operate three spring Chinook salmon, two summer Chinook salmon, one steelhead, and one coho salmon hatchery program. The Wenatchee hatchery programs originated with the Habitat Conservation Plan (HCP) settlement agreements⁴⁴.

The first of three spring Chinook salmon programs in the Wenatchee Basin is the Chiwawa River spring Chinook salmon hatchery program. Fish from this program are intended to spawn

⁴³ Wenatchee spring Chinook salmon supplementation includes the Chiwawa River and Nason Creek hatchery programs.

⁴⁴ Anadromous Fish Agreement and Habitat Conservation Plan (HCP) Rocky Reach (RR) Hydroelectric Project Federal Energy Regulatory Commission (FERC) License No. 2145 {CPUD, 2002 #8; Recitals A & B} and the Anadromous Fish Agreement and HCP Rock Island (RI) Hydroelectric Project FERC License No. 943 {CPUD, 2002 #9; Recitals A & B}. CPUD is responsible for funding elements of the hatchery programs related to ESA conservation and recovery goals of their HCPs {CPUD, 2002 #8; CPUD, 2002 #9}. GPUD is responsible for funding elements of the hatchery programs related to ESA conservation and recovery goals as a requirement of GPUD's license to operate the Priest Rapids Project issued by FERC {FERC, 2008 #10}. WDFW is the funding source for elements of the hatchery programs that are not CPUD and GPUDs' obligations under the HCPs or respective hydroelectric licenses.

naturally in the Chiwawa River for recovery of the endangered UCR Spring-Run Chinook salmon ESU. The program began with collection of wild broodstock in 1989. Under the terms of the Rock Island and Rocky Reach HCPs, the program originally was to produce 672,000 smolts annually until 2013, when the release numbers would be adjusted based on NNI recalculations. The program size was adjusted downward to 298,000 by the HCP Hatchery Committee, and further adjusted to 144,026 in 2013. Actual numbers released have differed considerably from the production goal due to variations in survival and the availability of broodstock. From 1989 to 1999, the program released an average of 95,610 fish (range 0 – 266 148); from 2000 to 2009 the program released an average of 375,135 fish (range 47,104-612,482) (Hillman et al. 2012). From 2001-2011, the program released an average of 393,847 fish (range 149,668 – 612,482) (Hillman et al. 2014)(Table 11).

Although the Chiwawa program has undoubtedly reduced extinction risk for the Wenatchee spring Chinook salmon natural population (abundance declined to record low numbers during the 1990s), the continued preponderance of hatchery-origin spawners is a risk to spatial structure and diversity and productivity. Additionally, the large number of hatchery fish in the basin may have reduced productivity through competition at the adult or juvenile levels. A final concern about the Chiwawa program is the extent to which Chiwawa adults spawn naturally outside the Chiwawa River but within the action area. This has likely reduced the amount of diversity among spawning aggregates, a loss of within-population diversity.

Table 11. Numbers of spring Chinook smolts tagged and released from the Chiwawa hatchery program, brood years 2001-2011 (Hillman et al. 2014).

Brood Year	Release Year	Total smolts released
2001	2003	377,544
2002	2004	148,668
2003	2005	222,131
2004	2006	494,517
2005	2007	494,012
2006	2007/2008	612,482
2007	2008/2009	305,542
2008	2010	609,789
2009	2011	438,561
2010	2012	346,248
2011	2013	281,821
Mean	2003-2013	393,847

There was also a spring Chinook salmon hatchery program in the White River (captive-broodstock program), but it was terminated after a final smolt release in 2015. The program was designed and operated to rescue, at least temporarily, spring Chinook salmon in the White River. Because of concerns about the loss of genetic diversity represented by the White River spawning aggregate, White River spring Chinook salmon were cultured in a captive broodstock program as a conservation measure beginning in 1997. Lauver et al. (2012) provides a complete history and

summary of results of the program. Overall, the White River program was beneficial in reducing extinction risk for the White River subpopulation. Although the last release of hatchery fish was in 2015, monitoring and evaluation of White River hatchery adult returns will continue through 2026.

The third hatchery program is the Nason Creek spring Chinook salmon program. Fish from this hatchery program are intended to spawn naturally in Nason Creek. It began with the collection of wild broodstock, from Nason Creek, in 2013. The first juvenile releases occurred in 2015 (Hillman et al. 2014). It is anticipated that the Nason program will reduce extinction risk for the Wenatchee spring Chinook salmon population. The Nason Creek hatchery program will be monitored carefully, similar to the Chiwawa River program, to reduce negative impacts on productivity and to reduce adverse genetic and ecological effects from adults or juveniles in the natural environment. Construction of the Nason Creek Acclimation Facility has been evaluated in a separate section 7(a)(2) consultation and NMFS found that implementation of the project would not jeopardize listed spring Chinook salmon or steelhead in the UCR, nor would it destroy or adversely modify designated critical habitat (NMFS 2012b).

The Chiwawa, White River, and Nason Creek spring Chinook salmon hatchery programs have been previously evaluated and authorized under separate ESA consultations, which are incorporated in the baseline by reference. Operation of the Chiwawa spring Chinook hatchery program has been evaluated and authorized in separate section 7(a)(2) consultation and section 10(a)(1)(A) Permit No. 1196 and Permit No. 18121 (NMFS 2004a; NMFS 2013b) (NMFS 2013d). Operation of the White River spring Chinook hatchery program has been evaluated and authorized in a separate section 7(a)(2) consultation and section 10(a)(1)(A) Permit No. 1592 and Permit No. 18120 (NMFS 2013b) {NMFS, 2007 #15}. In addition, a new spring Chinook hatchery program for Nason Creek has been evaluated and authorized in a separate section 7(a)(2) consultation and section 10(a)(1)(A) Permit No. 18118 (NMFS 2013b). The Chiwawa River and Nason Creek spring Chinook salmon hatchery programs pose both benefits and risks to the Wenatchee River spring Chinook salmon natural population. They have benefited the natural population by reducing short-term extinction risk (during record low adult returns in the 1990s). However, a high proportion of hatchery-origin spawners (pHOS) in the natural population poses risk (Ford et al. 2011). To balance benefits to natural spawning abundance against risks to diversity and productivity, the Chiwawa spring Chinook salmon program must meet or exceed a proportionate natural influence (PNI) of 0.67, measured as a 5-year running average. Because the above permits require a reduction in pHOS, which coincides with large reductions in hatchery releases (beginning in 2013) due to NNI recalculations, negative effects on diversity and productivity from the programs are anticipated to decline to desired levels within the next five years (NMFS 2013a).

Summer Chinook salmon programs exist in the Wenatchee and Entiat Basins. The Entiat hatchery program is part of the National Fish Hatcheries complex in the UCR operated by the USFWS. Maximum annual production would be 400,000 summer Chinook salmon smolts beginning in 2013. The Entiat summer Chinook salmon hatchery program was evaluated under a separate section 7(a)(2) consultation and NMFS found that implementation of the project would not jeopardize listed spring Chinook salmon or steelhead in the UCR, nor would it destroy or adversely modify designated critical habitat {NMFS, 2012 #6448}. This program replaces a

spring Chinook salmon hatchery program that was a risk to the spring Chinook salmon population in the Entiat River and to the UCR Spring Chinook Salmon ESU. Spring Chinook salmon production ceased in 2007 and the last adult hatchery spring Chinook salmon returned to the Entiat River in 2010.

The Wenatchee River and Chelan Falls summer Chinook salmon hatchery programs have been evaluated and authorized under a separate section 7(a)(2) consultation operated under Section 10 Permit No. 1347 (NMFS 2003a). From 1989 to 2000 (brood year), releases of juveniles from the Wenatchee River summer Chinook salmon program have averaged approximately 639,265 smolts annually (Hillman et al. 2014). From 2001 to 2011 (brood year), releases of summer Chinook salmon have averaged approximately 762,899 smolts annually (Table 12). Permit coverage was extended in September 2013 {Jones, 2013 #3442} and new section 10(a)(1)(B) consultation for the UCR summer/fall Chinook salmon programs are currently underway.

The subyearling Turtle Rock summer Chinook salmon program was discontinued in 2010. The release target for Turtle Rock summer Chinook subyearlings was 810,000 fish annually; the release target for Turtle Rock summer Chinook accelerated subyearlings was also 810,000 fish annually (Hillman et al. 2014). Production from the Turtle Rock summer Chinook subyearling programs were converted to the Chelan Falls yearling program. The release target for Turtle Rock summer Chinook salmon was 200,000 smolts for the period before brood year 2010. The current release target is 600,000 summer Chinook smolts. From 1995 to 2009 (brood year), the average annual summer Chinook salmon yearling smolt releases from Turtle Rock and Chelan hatchery programs were 137,625 and 233,429, respectively. From 2010 to present, the average annual summer Chinook salmon smolt releases from the Chelan Falls hatchery program were 573,142 (Hillman et al. 2014). The 2011 yearling summer Chinook salmon program achieved 96% (e.g., 827,709 fish released) of their 864,000-target goal.

Table 12. Releases of summer Chinook salmon from the Wenatchee summer Chinook salmon hatchery program.

Brood Year	Release Year	Number of smolts released
2001	2003	604,668
2002	2004	835,645
2003	2005	653,764
2004	2006	892,926
2005	2007	644,182
2006	2008	950,657
2007	2009	456,805
2008	2010	888,811
2009	2011	843,866
2010	2012	792,746
2011	2013	827,709
Mean	2001-2011	762,889

1
2 From 1939 to 1951, steelhead of unknown origin were trapped at Rock Island Dam, as well as
3 from the Wells Fish Hatchery from 1977 to 1997, and delivered to the LNFH for spawning,
4 progeny rearing, and release into Icicle Creek {Hall, 2014 #3439}. As mentioned in Section
5 2.3.2, the last adult returns from the LNFH occurred in 2000. From the 1960s through the early
6 1990s, WDFW and Chelan PUD released hundreds of thousands of hatchery steelhead in Icicle
7 Creek as well as several million hatchery steelhead in the Wenatchee River (Hall 2014c). In
8 addition, as early as 1933 and into the mid-1990s, rainbow trout from various origins⁴⁵ were
9 planted extensively in Icicle Creek as well as upper Icicle Creek lakes {Hall, 2014 #3439}.

10
11 There is a steelhead hatchery program in the action area funded and operated by CPUD and
12 WDFW. Until 1998, steelhead broodstock for this program were collected at Wells Dam and at
13 Priest Rapids Dam. This changed with creation of the Wenatchee program at Eastbank Hatchery,
14 which was authorized to release up to 400,000 fish annually, and was resized by the HCP HC to
15 247,300 fish in 2011. The Wenatchee steelhead hatchery program is intended to supplement the
16 natural origin steelhead population in the Wenatchee River and these fish are included in the
17 ESA-listed UCR Steelhead DPS. In 2012, the release of Wenatchee steelhead achieved 101% of
18 the 247,300 target goal (~249,004 smolts released into the Wenatchee and Chiwawa rivers and
19 Nason Creek) (Table 13). Juvenile steelhead releases in each of the three subbasins were
20 determined by the mean proportion of steelhead redds in each basin with about 28.9% and 19.0%
21 of the steelhead released in Nason Creek and the Chiwawa River, respectively (Hillman et al.
22 2014). The balance of program releases was split between the Wenatchee River downstream
23 from Tumwater Dam (21.3%) and the Wenatchee River upstream from the dam (30.8%)
24 (Hillman et al. 2014).
25

⁴⁵ Rainbow trout releases included both within-basin and out-of-basin stocks.

Table 13. Releases of summer steelhead smolts in the Wenatchee from 1998-2012 (brood year) (Hillman et al. 2014).

Brood Year	Release Year	Number of smolts released
1998 ^a	1999	172,078
1999	2000	175,701
2000	2001	184,639
2001	2002	335,933
2002	2003	302,060
2003	2004	374,867
2004	2005	294,114
2005	2006	452,184
2006	2007	299,937
2007	2008	306,690
2008	2009	327,143
2009	2010	484,772
2010	2011	354,314
2011 ^b	2012	206,397
2012	2013	249,004
Mean	1998-2010	312,649
Mean	2011 to present	227,701

To balance benefits to natural spawning abundance against the risks posed to diversity and productivity, the steelhead hatchery program must meet or exceed a proportionate natural influence (PNI) of 0.67, measured as a 5 year running average. PNI has also varied over the years. From 2001-2010, the proportion of natural spawners that were of hatchery-origin (pHOS) was high and averaged 67 percent, while the proportion of natural origin fish in the broodstock (pNOB) averaged 33 percent, yielding an average PNI of 35 percent (Hillman et al. 2012). For all brood years combined (2001-2013), the average PNI for the Wenatchee steelhead program was 50 percent (Hillman et al. 2014). Although the Wenatchee steelhead program undoubtedly reduced extinction risk, particularly during the mid-1990s, pHOS may have had a negative effect. Additionally, the large number of hatchery fish in the basin may have reduced productivity through competition at the adult or juvenile level. Operation of the Wenatchee River steelhead hatchery program was evaluated under a separate section 7(a)(2) consultation and section 10(a)(1)(A) Permit No. 1395 (NMFS 2003a; NMFS 2003b). NMFS found that implementation of the project would not jeopardize listed spring Chinook salmon or steelhead in the UCR, nor would it destroy or adversely modify designated critical habitat. Permit coverage was extended in September 2013 {Jones, 2013 #3442} and new section 7(a)(2) and section 10(a)(1)(A) consultations for the Wenatchee steelhead program are nearing completion. Because the new permit requires a reduction in pHOS, along with a large reduction in hatchery releases (beginning in 2013), this risk is anticipated to decline to desired levels within the next five years.

The Yakama Nations' coho reintroduction project is part of the Mid-Columbia Coho Restoration Project that involves ongoing studies, research, and artificial production of coho salmon in the Wenatchee and Methow river basins. The LNFH supports this project by providing hatchery facilities for part of its expanded coho salmon production program. This ongoing effort has undergone separate ESA section 7(a)(2) consultation (NMFS 2014). NMFS found that implementation of the project would not jeopardize listed spring Chinook salmon or steelhead in the UCR, nor would it destroy or adversely modify designated critical habitat.

Beginning in 1999, the Yakama Nation has released coho salmon into the Wenatchee Basin as part of the Mid-Columbia Coho Restoration Project (MCCRP). An average of 793,703 coho salmon smolts has been released annually from 1995 to 2011 (Kamphaus 2013){Hillman, 2013 #29} into Icicle, Beaver, and Nason Creeks, many of them reared at the LNFH (Table 14). In recent years an average of 61% of the Wenatchee coho salmon have been direct-released from the LNFH (Kamphaus 2015).

Table 14. Releases of coho salmon smolts in the Wenatchee Basin from 1995-2011 (brood year) {Kamphaus, 2013 #3350;Hillman, 2013 #28}.

Brood Year	Release Year	Number of smolts released
1995	1996	0
1996	1997	0
1997	1998	0
1998	1999	525,000
1999	2000	968,738
2000	2001	997,458
2001	2002	1,004,291
2002	2003	912,506
2003	2004	1,129,319
2004	2005	947,401
2005	2006	1,070,539
2006	2007	1,084,080
2007	2008	989,508
2008	2009	974,378
2009	2010	1,025,622
2010	2011	872,006
2011	2012	992,109
Mean	1997-2012	793,703

In summary, spring Chinook salmon and steelhead hatchery propagation in the action area have both positive and negative effects on ESA-listed Wenatchee spring Chinook salmon and steelhead. All of the hatcheries in the action area have undergone section 7(a)(2) consultation and in some cases, section 10(a)(1)(A) or section 10(a)(1)(B) permitting and were found to meet the ESA standards for avoiding jeopardy. The Wenatchee spring Chinook salmon supplementation programs have contributed to the survival and recovery of UCR spring Chinook

salmon. LNFH and Chiwawa River spring Chinook salmon hatchery strays likely had a negative effect (NMFS 2003a; NMFS 2003b) but those effects were reduced to low levels as reflected in the current pHOS levels. Hatchery influence on natural populations due to LNFH production, as well as steelhead and coho and summer Chinook salmon production from other hatcheries in the basin, may have reduced productivity for both ESA-listed adults and juveniles.

2.3.5. Fisheries

Another factor that NMFS considers in the environmental baseline is the effect on ESA-listed species from harvest. Regulations continue to apply to limit the number of ESA-listed UCR spring Chinook and steelhead that can be taken in fisheries. The Upper Columbia Salmon Recovery Board (UCSRB) has a firm commitment to pursue and support all possible fishing opportunities (sport and tribal) in the Upper Columbia consistent with meeting ESA obligations for ESA-listed populations (UCSRB 2007).

In the action area, fisheries are managed to selectively remove LNFH spring Chinook salmon and other hatchery salmon and steelhead that are surplus to natural spawning needs. Too many hatchery fish on the spawning grounds means the risks to natural population diversity and productivity can outweigh benefits from an increase in natural spawners. Because hatchery fish can occur together with fish from natural populations, fisheries encounter and catch-and-release natural origin fish at some cost (take) to the natural population. This “incidental” take can affect the abundance, productivity, diversity, and spatial structure of natural populations. These effects are balanced against the beneficial effects of removing hatchery fish in excess of natural spawning needs and the viability status of the affected natural population (i.e., risk factors for abundance and productivity and for spatial structure and diversity; Figures 5 and 7).

The linking of harvest with hatchery operations in a single plan (i.e., HGMP) is a relatively new approach to hatchery implementation (UCSRB 2007). In 2013, NMFS approved a new spring Chinook salmon fishery below Tumwater Dam in the lower Wenatchee River for the purpose of removing hatchery fish that were excess to natural spawning needs while achieving criteria for protecting spring Chinook salmon diversity (pHOS criteria) (NMFS 2013a; NMFS 2013b; NMFS 2013d). The take of ESA-listed natural origin spring Chinook salmon in the fishery is strictly limited based on the abundance of natural origin spring Chinook salmon returning to the Wenatchee River to spawn with a cap or maximum incidental mortality (i.e., catch-and-release mortality) of 2% (i.e., 2% of the natural-origin spring Chinook salmon returning to spawn that year). In recent years, Wenatchee River spring Chinook salmon abundance has averaged between 500 and 600 fish meaning fisheries targeting hatchery fish could commence annually until the incidental take (i.e., catch-and-release mortality) of natural-origin spring Chinook salmon has reached 10 to 12 fish. For UCR steelhead, spring Chinook salmon fisheries are also strictly regulated and limited to no more than 1 percent incidental mortality (natural origin and hatchery-origin combined). Current estimates based upon observed steelhead encounters during the Icicle Creek recreational spring Chinook salmon fishery and expanded for lower Wenatchee River fishery indicate an annual estimated encounter rate of 53 percent (using a 10-year geometric mean of encounters). This would provide a range of adult encounters from zero to ten steelhead during the proposed fishery (hatchery and natural origin combined). With a 10 percent incidental catch and release (hooking) mortality rate, this would result in the maximum incidental mortality

of 0.8 fish or approximately one ESA-listed steelhead annually (NMFS 2013a). Annual monitoring and reporting is required to ensure that these performance standards are met.

The harvest of UCR unlisted hatchery spring Chinook salmon within the action area varies from year-to-year depending on an abundance-based harvest rate schedule. Harvest will depend on the total abundance of upriver unlisted spring Chinook produced by the LNFH. It may be further limited by the availability of hatchery spring Chinook salmon produced by the Chiwawa and Nason safety-net programs, and the presence of ESA-listed natural origin spring Chinook with an allowable harvest range from 5.5% to 17% for unlisted hatchery spring Chinook salmon⁴⁶ in the Wenatchee Basin. Mainstem CR fisheries (outside of the Wenatchee Basin) and Icicle Creek fisheries (within the Wenatchee Basin action area) targeting Chinook salmon and steelhead produced by these programs have been evaluated and authorized under a separate opinion under the *U.S. v. Oregon Management Agreement* (NMFS 2008b).

Fisheries on hatchery-origin steelhead also occur in the Upper Columbia and Wenatchee River Basins. Due to the timing differences in runs between species, encounters with spring Chinook salmon during steelhead fisheries in the Wenatchee River action area are rare (NMFS 2013a). However, if, in the implementation of future steelhead fisheries, adult spring Chinook are encountered, incidental mortality is restricted to no more than one spring Chinook salmon handled and released. Effects of steelhead fisheries have been authorized under a separate ESA consultation (NMFS 2013d){NMFS, 2003 #2978;NMFS, 2003 #3209}.

In summary, harvest in the action area results in some incidental take of ESA-listed spring Chinook and steelhead but the numbers are very small and are likely to have negligible effects on Wenatchee River spring Chinook salmon and steelhead. All of the fisheries in the action area have undergone section 7(a)(2) consultation, and in some cases section 10(a)(1)(A) permitting, and were found to meet the ESA standards for avoiding jeopardy. NOAA Fisheries determined that implementation of UCR fisheries would not jeopardize listed spring Chinook salmon or steelhead in the UCR, nor would it destroy or adversely modify designated critical habitat.

2.3.6. Research, Monitoring, and Evaluation (RM&E)

LNFH RM&E activities are coordinated through the USFWS Mid-Columbia River Fishery Office (MRCFO) and include information on hatchery returns, straying rates, biological characteristics of the hatchery stock, fish marking, tag recovery, and other aspects of the hatchery program. RM&E programs are designed and coordinated with other research and monitoring projects in the Wenatchee Basin to maximize data collection while minimizing take of listed species. Related salmon and steelhead RM&E for Wenatchee Basin hatchery programs has been previously evaluated and authorized under the Rocky Reach Habitat Conservation Plan (NMFS's section 6(c)(1) Permit No. 6007.2100); WDFW and USFWS scientific research monitoring (NMFS 2002); and section 10(a)(1)(A) Permit No. 1196, 18118, 18120, and 18121 for UCR spring Chinook salmon (NMFS 1999a; NMFS 2004a; NMFS 2013a; NMFS 2013b; NMFS 2013c; NMFS 2013d) and Permit No. 1395 for UCR steelhead (NMFS 2003d). Impacts of related RM&E activities for the LNFH program on listed bull trout is authorized under a

⁴⁶ Out-of-basin, Carson stock spring Chinook salmon from the LNFH.

1 separate scientific permit through the USFWS {USFWS TE-702631`, MFR. 0-13`; \USFWS,
2 2011 #74}.

3
4 In summary, RM&E activities in the action may increase risk to the ESA-listed spring Chinook
5 and steelhead populations through incidental effects such as temporary disturbance or
6 displacement during observational monitoring. The proposed action does not include research
7 but only sampling, and marking of LNFH fish in the hatchery or observational surveys at the
8 spillway pool that includes no incidental take of listed species. All other RM&E activities listed
9 above that include direct and incidental take have undergone section 7(a)(2) consultations and
10 were found to not jeopardize the species.

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